Iron and Steel ENGINEER

ENGINEERING SERVICE TO THE IRON AND STEEL INDUSTRY SINCE 1907

APRIL, 1952

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TECHNOLOGY DEPT.

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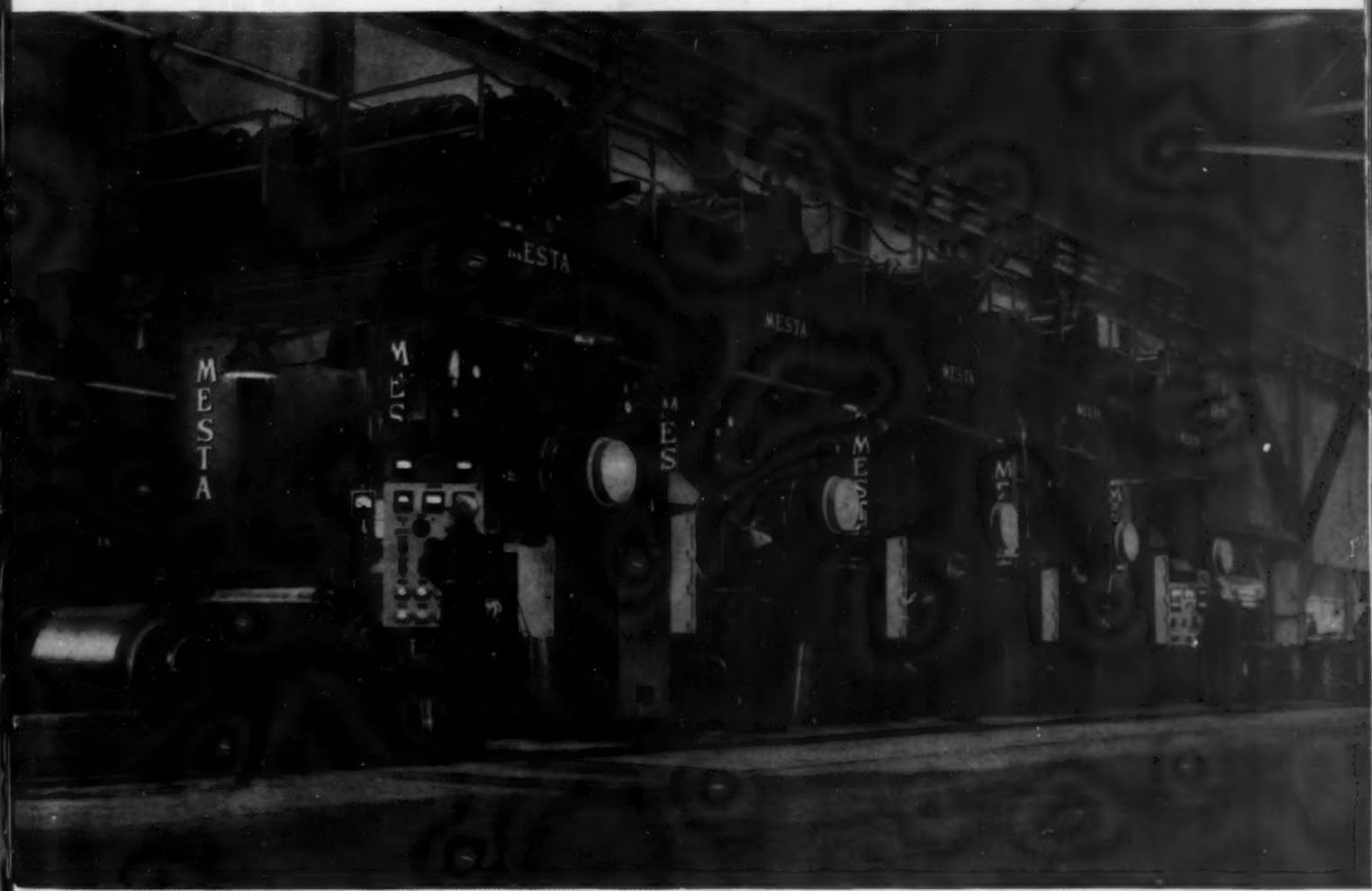
DEPT.

Modern high-speed Cold Mills

designed and built by MESTA



Color Photo by E. D. MESTA

Mesta 56" Four-High, Five-Stand Tandem Cold Mill installed in a Large Canadian Steel Plant.

DESIGNERS AND BUILDERS OF COMPLETE STEEL PLANTS

MESTA MACHINE COMPANY · PITTSBURGH, PA.

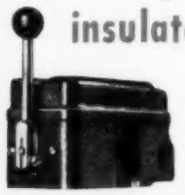
New Cam Operated MILL ACCESSORY MASTER

Has 3 separate insulated circuits

"FIVE BY FIVE"

Actual size of case 5½ x 5¼ x 5½

Also in 6 separate insulated circuits



Case measures 5½ x 5¼ x 8⅛

The new Cutler-Hammer Mill Accessory Master has been designed for the many steel mill applications where a cam operated type master switch of very small dimensions is required. This new small master is available with either 3 or 6 separate insulated circuits; cast iron case for surface mounting and in skeleton or sheet metal case for back-of-panel or bench-board flush mounting.

Five standard models are available for these usual types of magnetic controllers:

1. Single speed reversing without low voltage protection in the 3 circuit master.
2. Single speed reversing with low voltage protection in the 3 circuit master.
3. Two speed reversing without low voltage protection in the 3 circuit master.
4. Two speed non-reversing with low voltage protection in the 3 circuit master.
5. Single or two speed non-reversing or reversing with or without low voltage protection in the 6 circuit master.

In addition, both the 3 circuit and 6 circuit master may be had with "daisy-petal" twist-off cam elements adaptable to special circuit requirements . . . which enable you to stock a supply of these masters and tailor each to the requirements of each application.

The switch is provided with double break bridging contacts, molded arc-resistant arcing chambers. The switch has positive star wheel action with readily adjustable star wheel tension. Star wheel cam and roller, and switch cams and rollers, are case hardened. The cam shaft is mounted on self-aligning ball bearings. Handle can also be furnished as self-centering from either or both directions. The clamp-on type handle is readily adjustable to any angular position. The cast iron case of the surface type enclosure has conduit openings in both sides and one in the bottom. The switch is easy to wire, with solderless type lugs; each terminal is arranged for two wires. Rugged construction assures low maintenance. CUTLER-HAMMER, Inc., 1269 St. Paul Ave., Milwaukee 1, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ontario.

where can YOU use

this new mill accessory master?

HERE ARE BUT A FEW OF MANY PRESENT USES:

Blowers	Lifts	Pickling Tanks
Conveyors	Saws	
Electric Heaters	Machine Tools	Sizing Mills
Kick-offs	Mandrel Extractors	Solenoid Valves
Levelers		

A pair of pliers does the trick!

When You Tailor This Master To The Job

When there are special circuit requirements to be met, both the 3 circuit and 6 circuit masters are available with "daisy-petal" twist-off cam elements which can be "tailored" to the needs of the specific job. Petals can be twisted off with a pair of pliers to form any cam arrangement.

CUTLER-HAMMER
MOTOR CONTROL
C-H

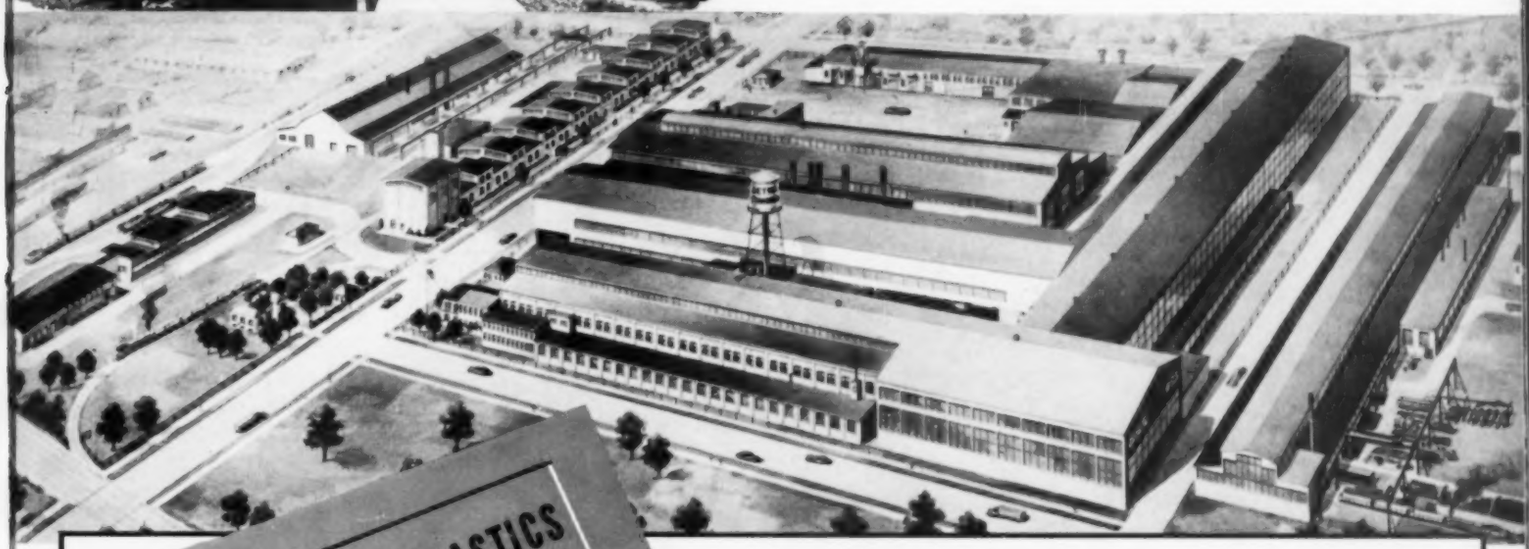
IRON AND STEEL ENGINEER; published monthly by Association of Iron and Steel Engineers, 1010 Empire Bldg., entered as second class matter January 25, 1924 at Pittsburgh, Pennsylvania, under Act of Congress, March 3, 1879. $7.50 per year in United States and Canada, $10.00 foreign countries. Volume 29, No. 4

aetna-standard completes two-year expansion program

• The two-year expansion program gives Aetna-Standard additional facilities to meet delivery schedules for tube mills, flat-rolled equipment, wire-drawing products, drawbenches and other machinery for the metal industry.

At the big Ellwood City plant . . . a new Roll Foundry features foundry handling equipment and many innovations. Additional assembly and machine shop capacity has been added, augmented by many new machine tools. Executive offices are now located in the Frick Building, Pittsburgh, Pa. . . . General Offices in Ellwood City.

Aetna-Standard recently completed 50 years of Creative Engineering service to the ferrous and non-ferrous industries and looks forward with confidence to another fifty.



BUYS RUBBER & PLASTICS MACHINERY DIVISION OF *National-Erie*

The facilities of the Warren, Ohio, plant will be used primarily for the production of machinery for the rubber industry. Aetna-Standard has purchased the patterns, drawings and some machinery of the rubber and plastic products division of the National-Erie Corporation, Erie, Pa., subsidiary of Bucyrus-Erie Company.

ASSOCIATED COMPANIES

Head Wrightson Machine Company, Ltd., Middlesbrough, England — Great Britain, Finland, Sweden, Norway, Denmark, Union of South Africa, Northern and Southern Rhodesia.

Aetna-Standard Engineering Company, Ltd., Toronto, Ontario, Canada.

M. Castellvi, Inc., New York, N. Y. — Mexico, Central and South America.

Societe de Constructions de Montbard, Paris, France — France, Belgium, Holland, Luxembourg, Switzerland.

Demag Aktiengesellschaft, Duisburg, Germany — Germany, Austria, Yugoslavia, Greece, Turkey, Egypt.

Compagnia Italiana Forme Acciaio, Milano, Italy — Italy.

Aetna-Japan Company, Ltd., Tokyo, Japan — Japan.

Hale & Kullgren, Inc., Akron, Ohio — Representative for the Rubber Industry.

Designers and Builders to the Ferrous, Non-Ferrous, Leather and Rubber Industries

Aetna-Standard

THE AETNA-STANDARD ENGINEERING COMPANY • PITTSBURGH, PA.

Plants in Warren, Ohio · Ellwood City, Pennsylvania

Wherever steel is rolled
you'll find **NATIONAL ROLLS**

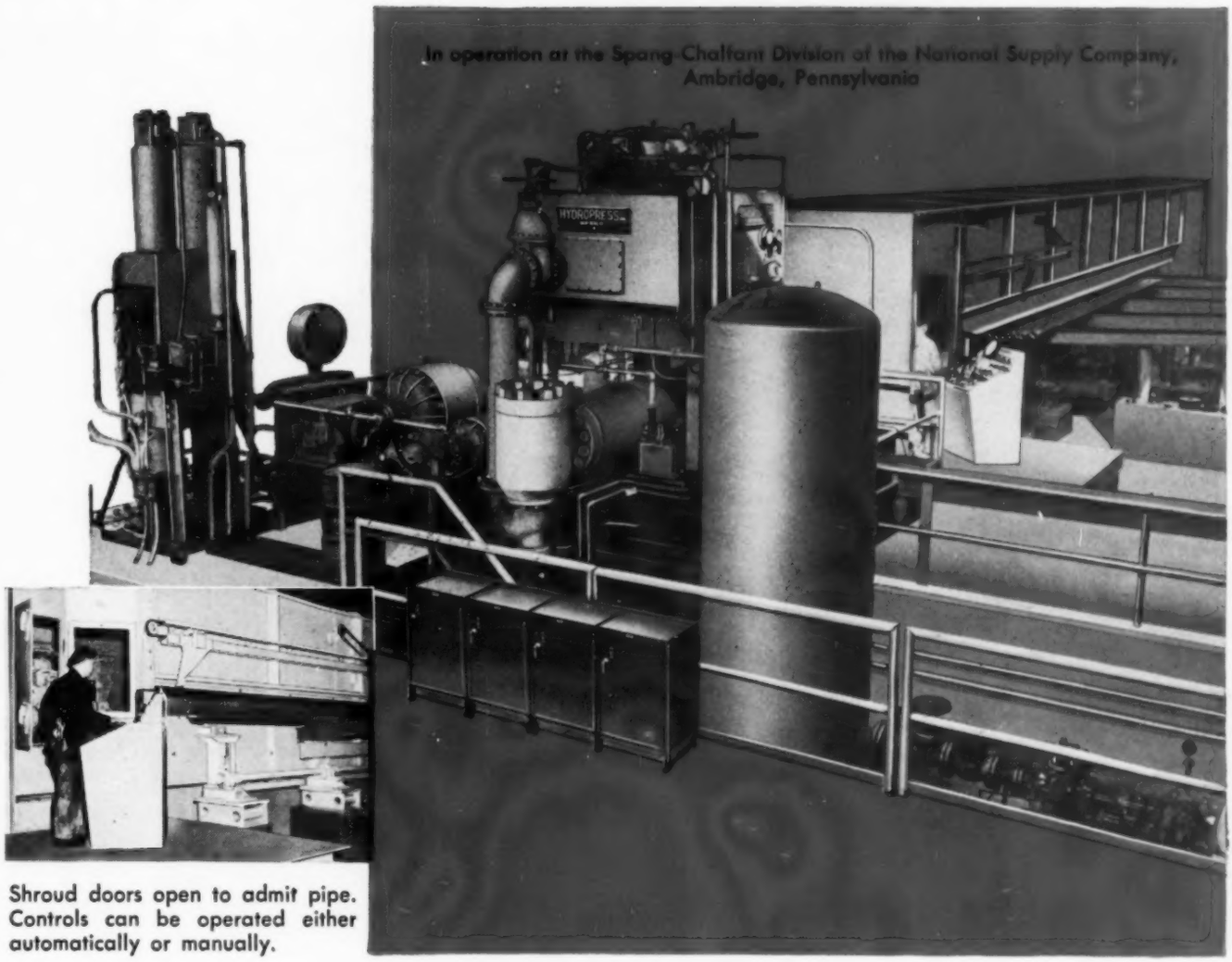
Not only in this country but in the leading rolling mills in South America, Canada, Western Europe, National Rolls are well-known for their dependable performance and long tonnage life.

This reputation, built up over the forty-three years that National has been making rolls, is maintained by National's skilled metallurgical staff which maintains close supervision over quality control in every phase of production of National Rolls.

SPECIALISTS IN IRON AND
ALLOY IRON ROLLS AND CASTINGS

THE NATIONAL ROLL & FOUNDRY CO.
Avonmore, Pennsylvania

10,000 PSI



Shroud doors open to admit pipe. Controls can be operated either automatically or manually.

AUTOMATIC HYDROSTATIC
PIPE TESTING
MACHINES

ONE-MAN OPERATION • HIGH-PRODUCTION RATE • SEAMLESS AND WELDED PIPE

"Half-million dollar proving ground for pipe...to do the job well...."

SAYS THE NATIONAL SUPPLY COMPANY

to whom we supplied this installation for testing seamless steel pipe to pressures up to 80% of the minimum yield strength of the material.

WRITE FOR FULL INFORMATION TO DEPT. 82

LOEWY
HYDROPRESS INC.
ENGINEERS • CONTRACTORS

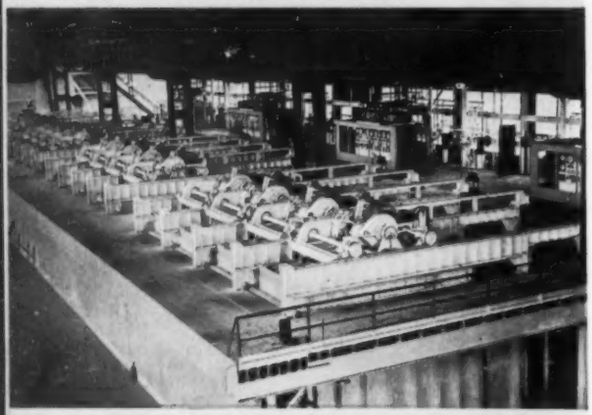
Hydraulic Presses • Accumulators • Pumps • Rolling Mills • Die Casting Machines

570 LEXINGTON AVENUE** at 51st Street **NEW YORK 22, N.Y.

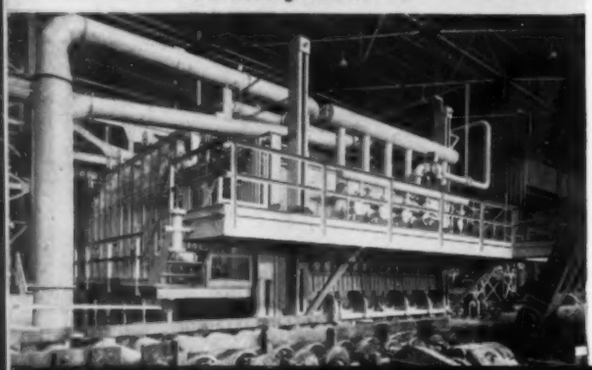
BIRMINGHAM, ALA. • CHICAGO • CLEVELAND • DETROIT • LOS ANGELES • SAN FRANCISCO • SEATTLE • WASHINGTON, D. C.

WHEN URGENT PRODUCTION SCHEDULES

One-way fired soaking pits.



Slab heating furnaces.



• Steel-makers who must increase tonnage and maintain quality, to meet urgent demands, find 'Surface' heating and heat treating equipment superbly suited to their needs.

And here's why: Scores of operating and engineering executives in the metal producing and metal working industries, in cooperation with 'Surface' engineers, helped build 'Surface' equipment. Continuous laboratory research in scientific application of gases, heat and mechanisms to many heating problems have netted improved 'Surface' equipment that *produces*—dependably and economically—year after year. Into each installation goes the know-how accumulated by men who have spent their lives in working in and with the steel industry. Now, when prompt, quality tonnage is vital, 'Surface' offers modern processes and methods that *deliver the steel.* Write us today.

SURFACE COMBUSTION CORPORATION • TOLEDO 1, OHIO

FOREIGN AFFILIATE COMPANIES

BRITISH FURNACES LIMITED—CHESTERFIELD
STEIN & ATKINSON, LTD.—LONDON
STEIN & ROUBAIX—PARIS, LIEGE AND GENOA
WILL L. SMITH, S.A.—BUENOS AIRES

'Surface' SERVES THE STEEL INDUSTRY

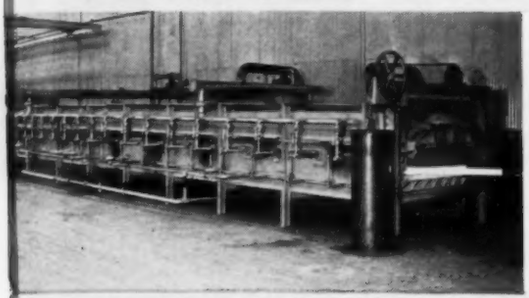
One-Way Fired Soaking Pits • Billet Reheating Furnaces • Slab Heating Furnaces • Continuous Type, Controlled Atmosphere Strip Annealing and Normalizing Furnaces • Controlled Atmosphere Annealing Covers for Wire and Rod • Controlled Atmosphere Annealing Covers for Coil and Sheets • Continuous Furnaces for Heat Treatment of Steel Plate • Controlled Atmosphere Furnaces for Carbon Correction in High Alloy Rod and Bar Stock • Continuous Type Bright Annealing and Normalizing Furnaces • Prepared Gas Atmosphere Generating Equipment • Pit Type Convection Furnaces for Rod Annealing • Stress Relief Furnaces • Wire Patenting Furnaces

DEMAND

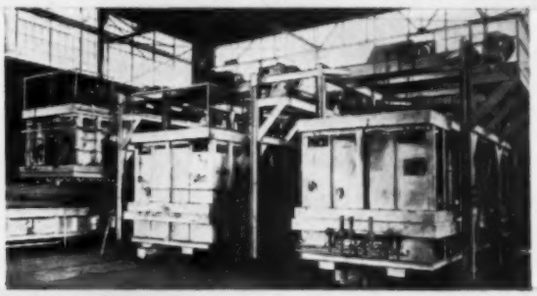
heat

FROM INGOT THROUGH FINISHED PRODUCT

Wire patenting furnaces.

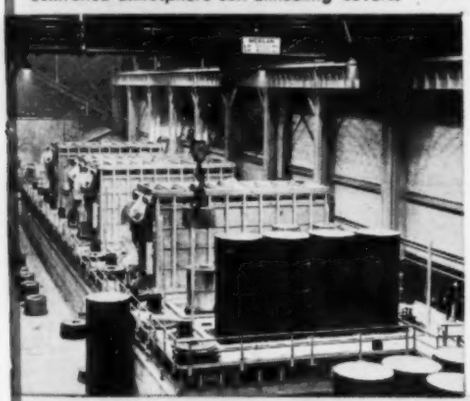


Batch type carbon correction annealing furnaces.

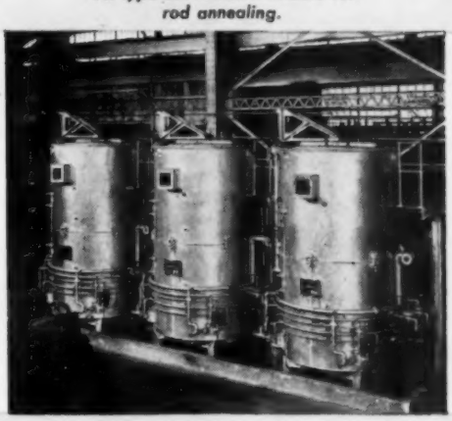


Continuous bright annealing and normalizing furnaces for tubing.

Controlled atmosphere coil annealing covers.

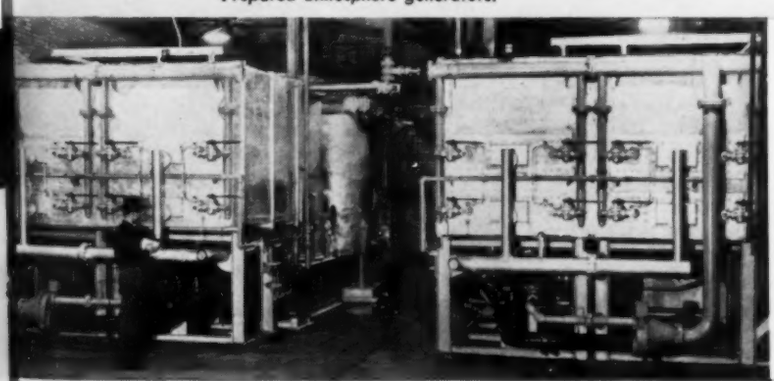


Pit type convection furnaces for rod annealing.



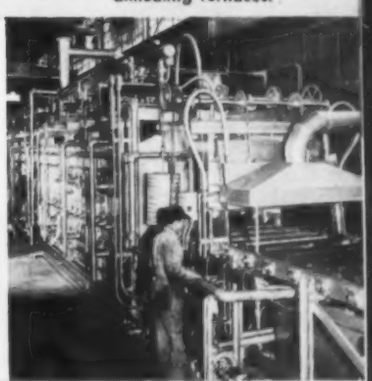
Continuous strip annealing and normalizing furnaces.

Prepared atmosphere generators.



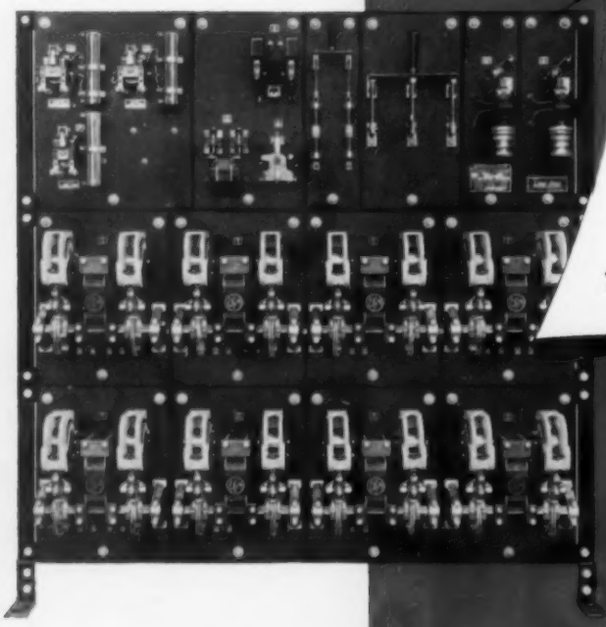
Stress relief furnaces.

Continuous controlled atmosphere annealing furnaces.



Continuous armor plate heat treating furnaces.

Controlled atmosphere wire and rod annealing covers.



LOOK for these NAMES when buying Motor Control

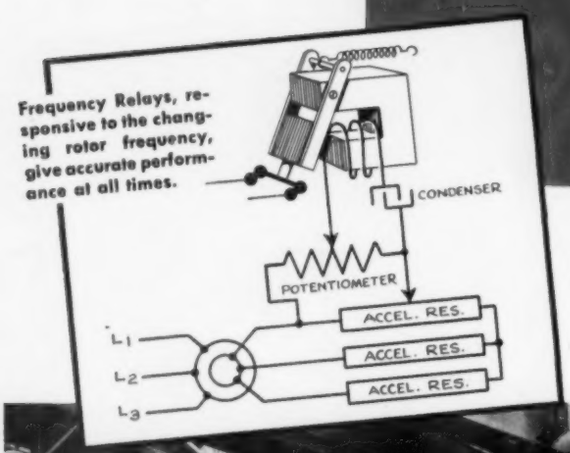
1 LINE-ARC Contactors
2 TIME-CURRENT Acceleration (D-c)
3 FREQUENCY RELAY Acceleration (A-c)
4 WRIGHT CIRCUIT Hoist Control (D-c)
5 YOUNGSTOWN Hoist Limit Stops
6 TYPE WB Brakes
7 CAM Master Switches
8 MANUAL-MAGNETIC Disconnect Switches
9 CONTRA-TORQUE Hoist Control (A-c)
10 TAB-WELD Resistors

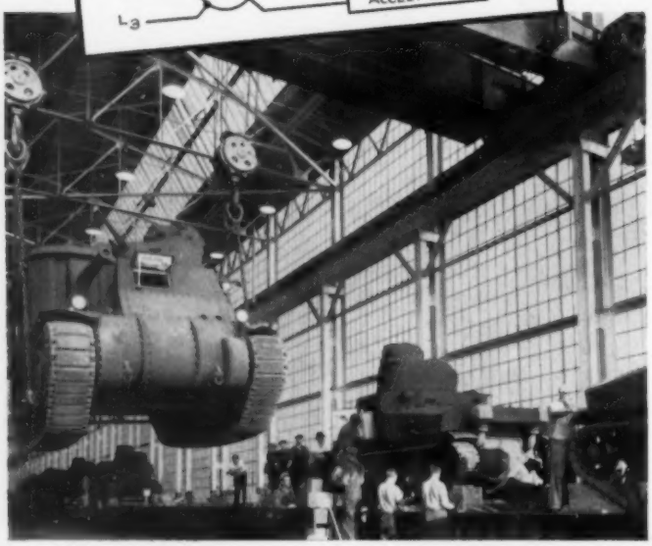
These FUNCTIONAL NAMES Speak for Themselves

FREQUENCY RELAYS
ACCELERATING —
— PLUGGING —
— SPEED LIMITING

Improve PERFORMANCE,

because these relays operate *accurately* over the entire speed range of a-c wound-rotor motors.





You can rely on EC&M FREQUENCY RELAYS to control a-c wound-rotor motors with precision throughout all operating speeds. *Good inching*, because weak torques for slow speeds may be used safely. *Plugging point*, accurately controlled by one FREQUENCY RELAY, with refined adjustment to close the plugging contactor at exact standstill. *Smooth acceleration* from standstill or a coasting start; heavy overhauling loads do not overshoot regenerative lowering speeds.

FREQUENCY RELAYS are inherently designed with quick pickup and clean dropout. Unlike previous standard relays connected to the rotor circuit and having a narrow range of adjustment with resultant high maintenance to keep them adjusted, EC&M FREQUENCY RELAYS operate from a resonant circuit *and are accurate*.

For improved performance, specify EC&M FREQUENCY RELAY Control for your next a-c wound-rotor motor installation.

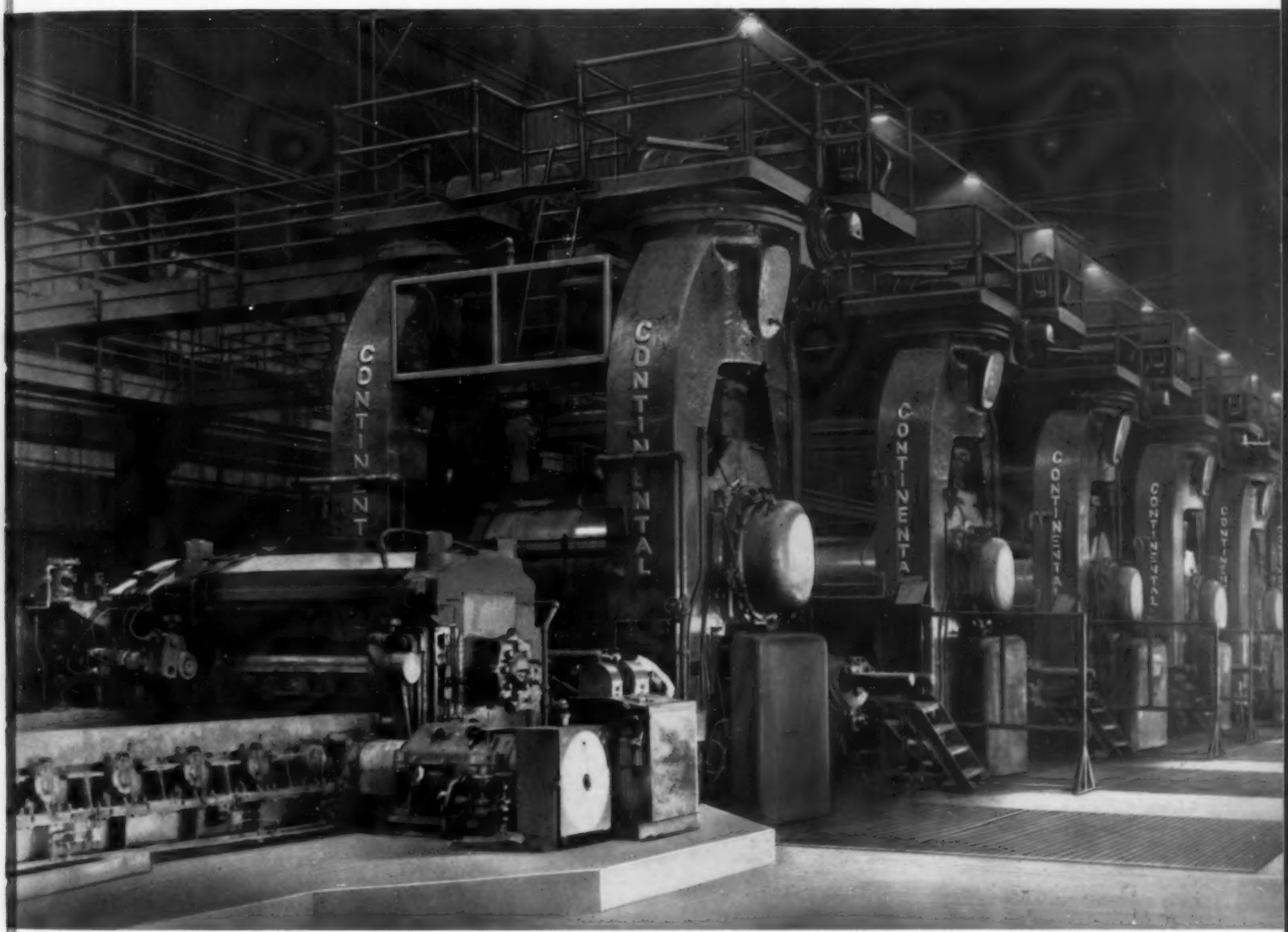
ACCURATE INCHING for lowering turret-tops, etc., and other assembly operations; also when loading tanks for shipment.

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET • CLEVELAND 4, OHIO

E&M

Continental

80-Inch HOT STRIP MILL



Complete Rolling Mill Installations:

BLOOMING MILLS • STRUCTURAL MILLS • RAIL MILLS
BILLET MILLS • ROD MILLS
BAR MILLS • MERCHANT MILLS • SLABBING MILLS
UNIVERSAL MILLS • PLATE MILLS
HOT STRIP MILLS • COLD STRIP MILLS • TEMPER MILLS
ROLL LATHES • SPECIAL MACHINERY

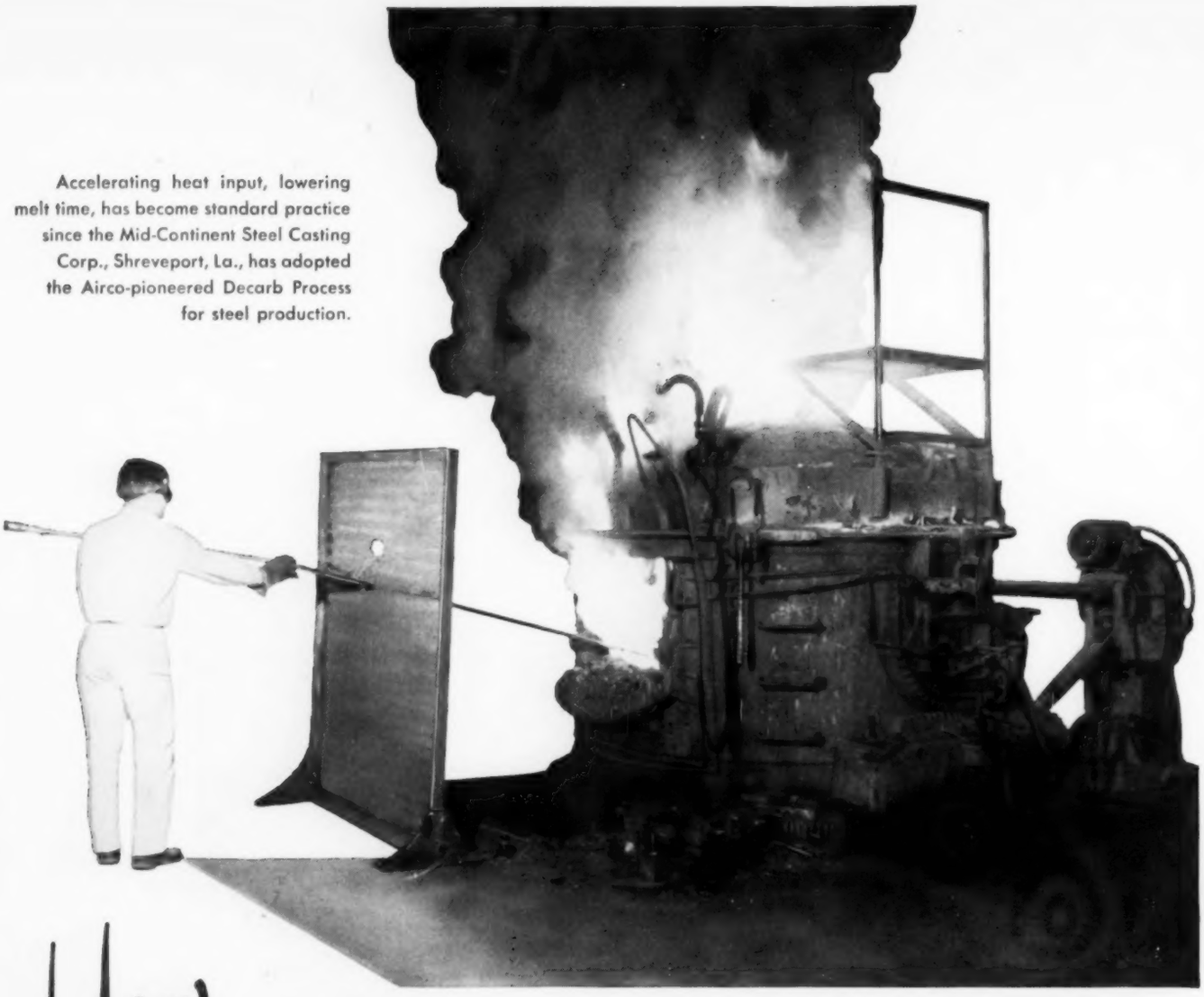
CASTINGS—carbon and alloy steel from 20 to 250,000 pounds

ROLLS—iron, alloy iron and steel rolls for all types of rolling mills

CHICAGO • PITTSBURGH

Plants at: *East Chicago, Ind.* • *Wheeling, W. Va.* • *Pittsburgh, Pa.*

CONTINENTAL
Foundry & Machine
Company



Accelerating heat input, lowering melt time, has become standard practice since the Mid-Continent Steel Casting Corp., Shreveport, La., has adopted the Airco-pioneered Decarb Process for steel production.

How TO INCREASE STEEL PRODUCTION

use less power–save more time

WITH AIRCO'S STEEL DECARBURIZATION PROCESS

Oxygen injected under the slag cover at 80 psi has become the answer to Mid-Continent's faster steel production.

Increased bath temperature—faster carbon elimination—lower power consumption . . . time saved per heat . . . gives Mid-Continent a product with the same normal chemistry, slag control and fluidity as they formerly received using ore. Additional workflow advantages are gained by the elimination of ore handling and storage problems.

Oxygen decarburization for faster heats may be put to work for you. The facilities of our Technical Sales Division may furnish you with the answers you need to know about this process for your use. If you are interested in obtaining further information, please address your nearest Airco office.

AT THE FRONTIERS OF PROGRESS YOU'LL FIND

AN AIR REDUCTION PRODUCT

AIRCO®

DEALERS AND OFFICES IN PRINCIPAL CITIES

AIR REDUCTION

AIR REDUCTION SALES COMPANY • AIR REDUCTION MAGNOLIA COMPANY • AIR REDUCTION PACIFIC COMPANY

REPRESENTED INTERNATIONALLY BY AIRCO COMPANY INTERNATIONAL

DIVISIONS OF AIR REDUCTION COMPANY, INCORPORATED

"Tycol Anepro carries heaviest loads... lowers bearing failure...slices lubrication costs"

Indeed it does! Tycol Anepro Greases measure up to severest shock-load conditions encountered in the rolling of steel. They protect bearings from moisture, heat, and abrasive impurities. Anepro's exceptionally high film strength and non-corrosive properties result in far longer bearing life . . . faster rates of production . . . minimum down-time for heavy-duty equipment.

Call or write today for complete information from your nearest Tide Water Associated office.

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TIDE WATER ASSOCIATED OIL COMPANY

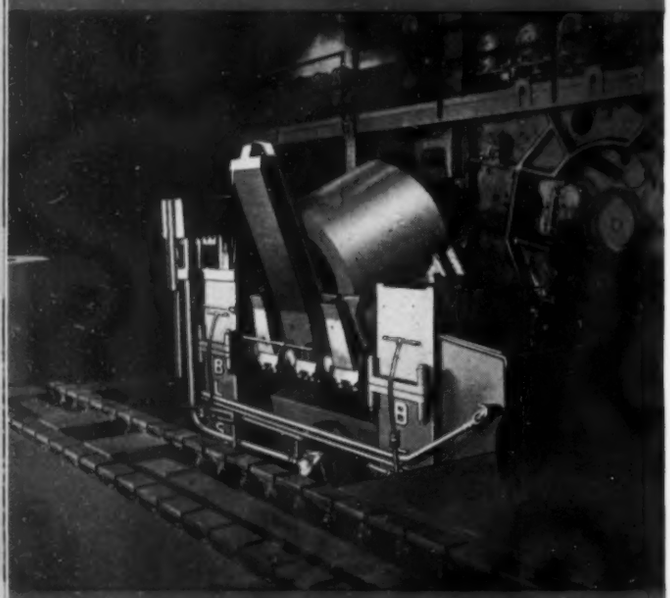
17 BATTERY PLACE · NEW YORK 4, N.Y.

SEND FOR A FREE COPY OF "TIDE WATER ASSOCIATED LUBRICANIA"

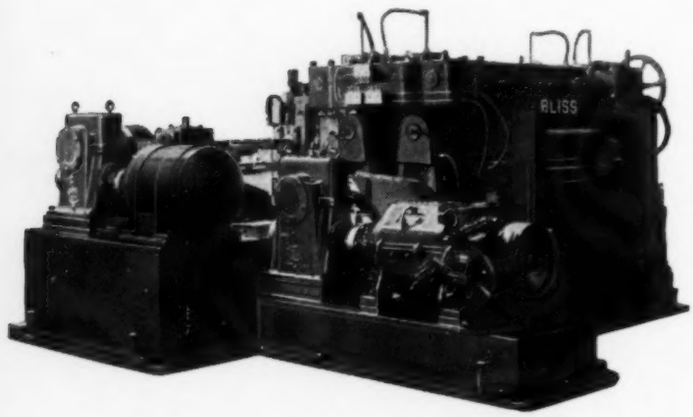
HOW BLISS DESIGNS FOR STEEL, BRASS

PRIMARY METAL PLANTS use hundreds of Bliss special-purpose machines in conjunction with hot and cold reduction mills. In every case, backed by field research with industry's engineers, Bliss has drawn upon its engineering skills to create equipment combining the necessary ruggedness and precision for the job at hand.

Pictured on these pages are typical exam-

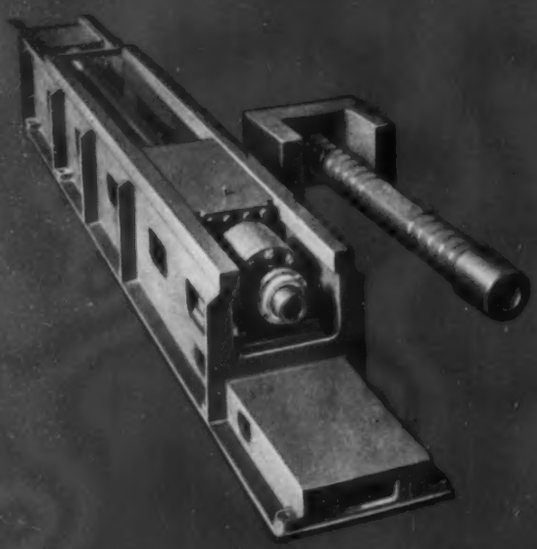


COIL UPENDER strips hot 25,000-pound coils from the Mandrel Coiler, upends and deposits them on a "waffle top," which in turn deposits coils on the moving conveyor strands without damage to coil edges.



13 ROLL BREAKER produces scale-free and inclusion-free product which is suited for final reduction operations.

RUN OUT DELIVERY TABLE specially designed by Bliss has slab sweep-off sections opposite piler. A slab pusher is provided on one side.



ROLL CHANGER WITH SLIDING RAIL permits easy roll removal from the mill and reduces required crane capacity. Balance bar is used to handle work roll assemblies including chocks and bearings.

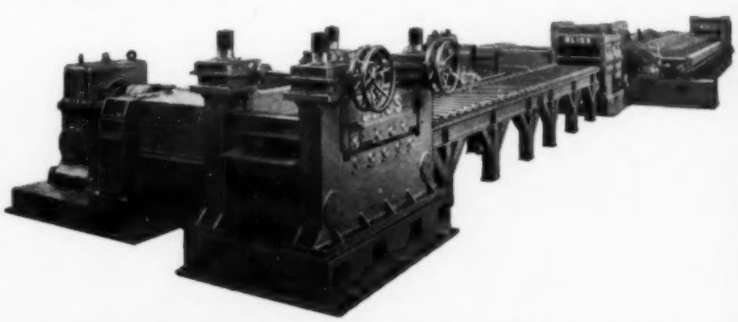
AUXILIARY EQUIPMENT AND ALUMINUM MILLS

ples of mill accessory equipment designed by Bliss. The complete range is described and illustrated in a new 52-page brochure soon to be published. You can reserve your copy now.

Next time you need auxiliary mill equipment, call in Bliss engineers.

E. W. BLISS COMPANY, General Office: Canton, Ohio
ROLLING MILL DIVISION: SALEM, OHIO
E. W. Bliss (England) Ltd., Derby, England
E. W. Bliss Company (Paris), St. Ouen sur Seine, France
PRESSES, ROLLING MILLS, SPECIAL MACHINERY

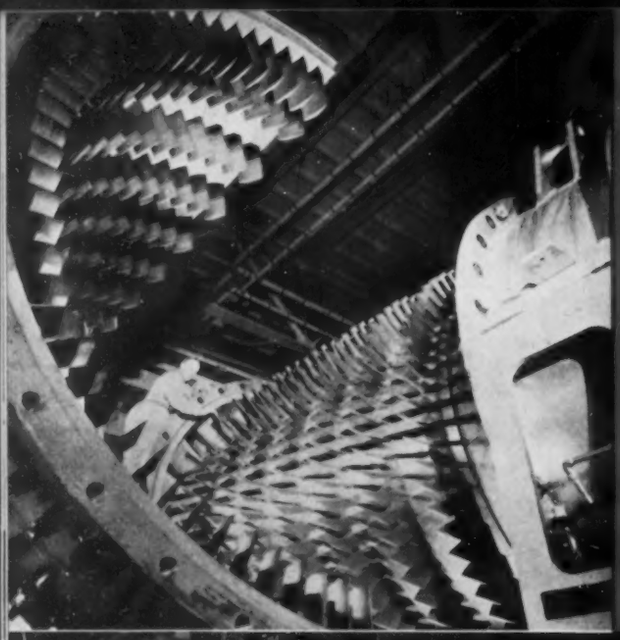
WIDE HORIZONTAL-TYPE BELT WRAPPER is used in conjunction with Tension Reel to coil strip on the fly into tight, uniformly wound coils.



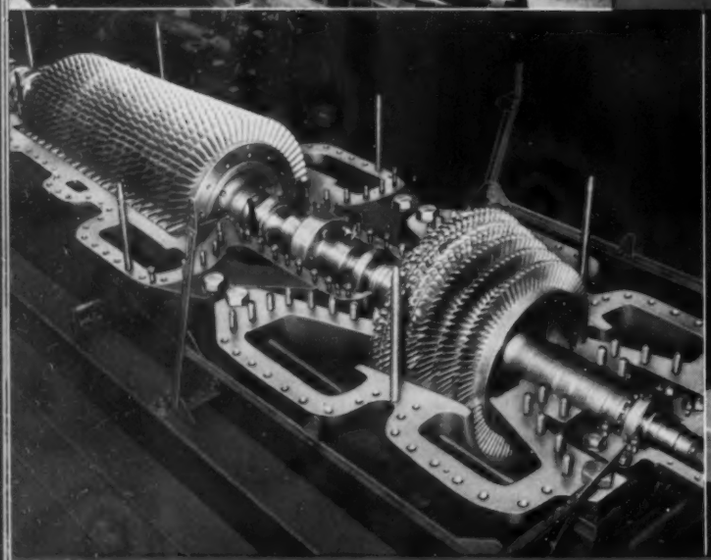
COMBINATION LEVELER AND SLAB MILLER levels the slab, mills one side, turns the bar over and mills the other side. It is used in brass and aluminum mills to prepare metal for final cold reduction.

COIL LIFT AND TURN-AROUND UNIT transfers coils weighing up to 30,000 pounds from one leg of conveyor to another. It operates at either 90° or 180°. Perfect coil edges are retained.

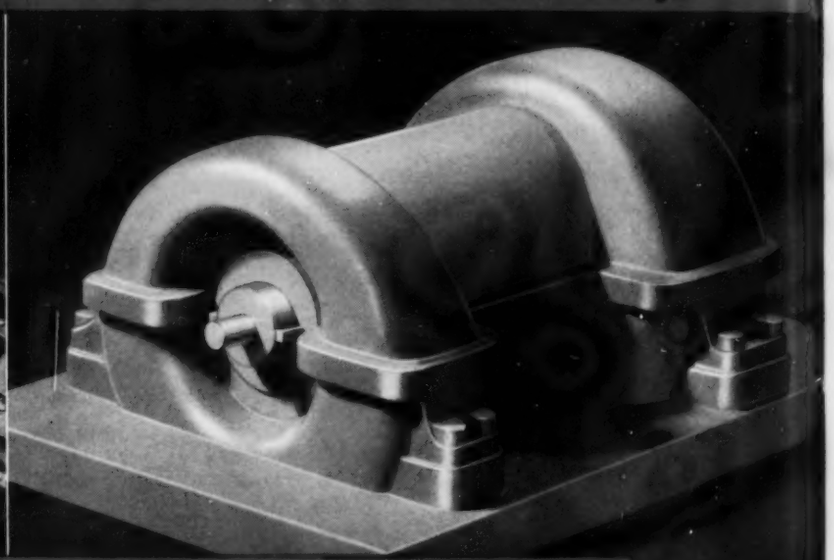
TENSION REEL AND BELT WRAPPER handles 30,000-pound coils. Forced-circulation oil lubrication pump and piping are shown clearly on the typical Bliss gear reduction unit.



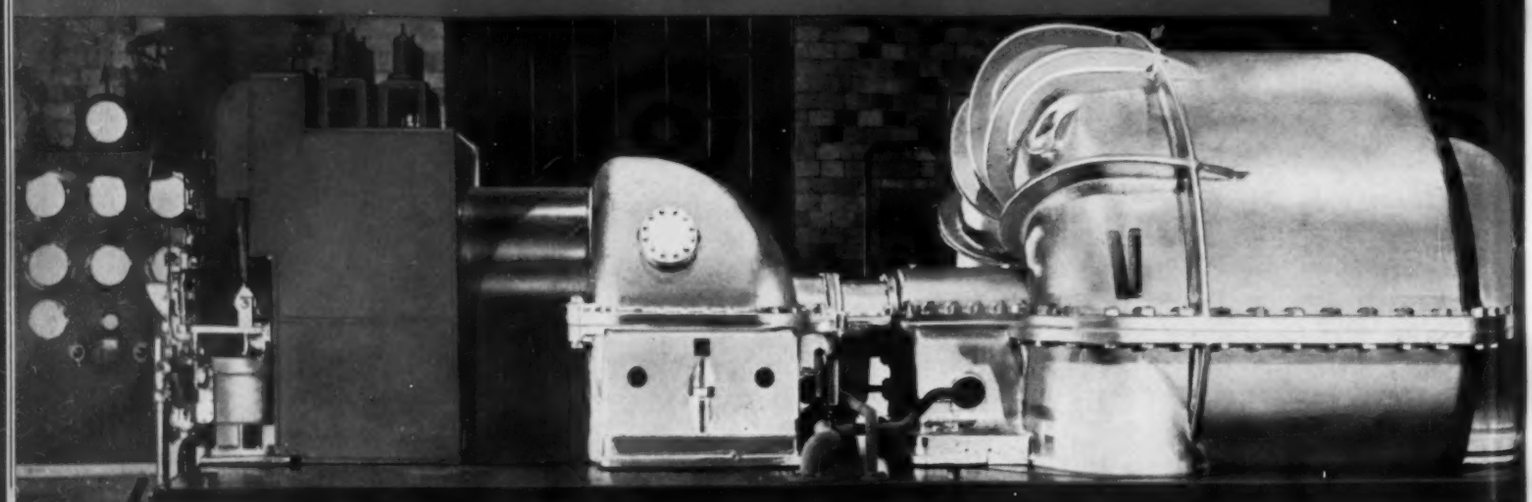
This Allis-Chalmers 870,000 cfm axial compressor drives the world's fastest wind tunnel, located at NACA Langley Aeronautical laboratories, Hampton, Va. The seven stage, 55-ton rotor is so perfectly balanced and friction-free that a man can move it with one finger.



Construction view of 40,000 cfm, 45 psig axial compressor used in petroleum refining. Over 30 of these units, ranging from 16,000 to 60,000 cfm, have been built by Allis-Chalmers over the past 15 years.



Scale model of axial compressor as designed for blast furnace service at 110,000 cfm, 30 psig. The axial compressor is ideally suited for the production of large air volumes at pressures up to 40 lbs. psig.



Allis-Chalmers has wide experience in designing and building air moving equipment for all industries. Shown here is an A-C 75,000 cfm, 30 psig blast furnace blower at a midwestern steel mill. This is of the centrifugal type, driven by A-C 8500 hp steam turbines.

ALLIS-

Job Moving Air

...Quantity No Object!

ALLIS-CHALMERS OFFERS AXIAL COMPRESSORS FOR BLAST FURNACE BLOWING

THE TREND TO HIGH TOP PRESSURE and larger air volumes in blast furnace blowing finds the efficient and field-proven axial compressor ready and able to supply the largest projected blast furnace or combinations of furnaces!

Allis-Chalmers — builders of both axial and centrifugal compressors — is now offering axial compressors for blast furnace service at volumes over 100,000 cfm, and at pressures of 30 psig and higher. With comparable first cost, steam savings on the order of 15 percent are possible because of axial "straight-through" air flow and higher speed operation.

An axial compressor of 110,000 cfm, 30 psig in routine blast furnace service would require 72,100 lb of steam per hr at 600 psig, 825 F, as compared to 85,-800 to drive a like centrifugal unit. Installation space and foundation costs are also reduced, since the higher rotative speed makes the axial unit shorter, more compact and lighter.

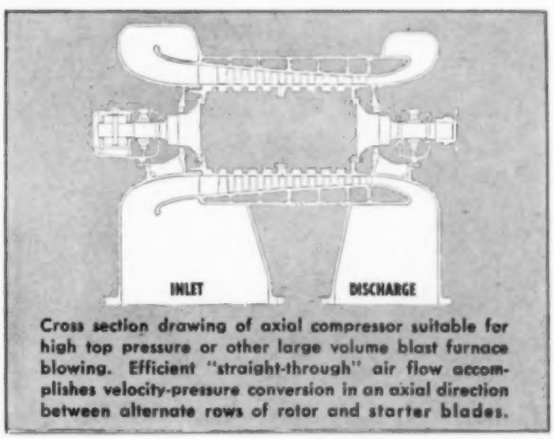
As air volumes increase, the axial compressor rapidly becomes the only practicable method. The air volumes required for even the largest foreseeable blast furnace application present no new design problems for an axial compressor. And wear-resistant alloy, precision cast blades are ideal for contaminated atmospheres.

One Allis-Chalmers axial (see upper left) has operated for four years at an output of 870,000 cfm! A-C axial design and construction have been well proven in the past 15 years with nearly *four million* cfm in capacity already in use or under construction for the petroleum, aircraft, railroad, and gas utility industries.

Blast furnaces can have their progress to more efficient size and pressures *aided* by adopting the more efficient axial compressor. Get the *full* story on how an Allis-Chalmers axial can best solve your need for large air volumes.

There is a qualified steel mill representative near you, ready to explain the axial compressor in detail. Just call the nearest A-C sales office or write for literature to Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3661

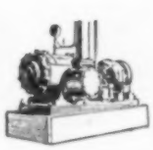


Cross section drawing of axial compressor suitable for high top pressure or other large volume blast furnace blowing. Efficient "straight-through" air flow accomplishes velocity-pressure conversion in an axial direction between alternate rows of rotor and starter blades.

SINGLE STAGE BLOWERS available in pressure ranges from one to 6.50 lb. Rigid, long-lived cast casing can be arranged to any one of 24 discharge positions.

ROTARY COMPRESSORS, sliding vane type. Capacities for 5 to 35 psig. Air is compressed in cells formed by blades moving freely in and out of longitudinal slots in rotor.

DRY VACUUM PUMPS. Range to 28½ inches hg vacuum. Same principle as rotary compressors except that action is reversed—inlet evacuates, exhaust is open.



CHALMERS

A-C ALLIS-CHALMERS

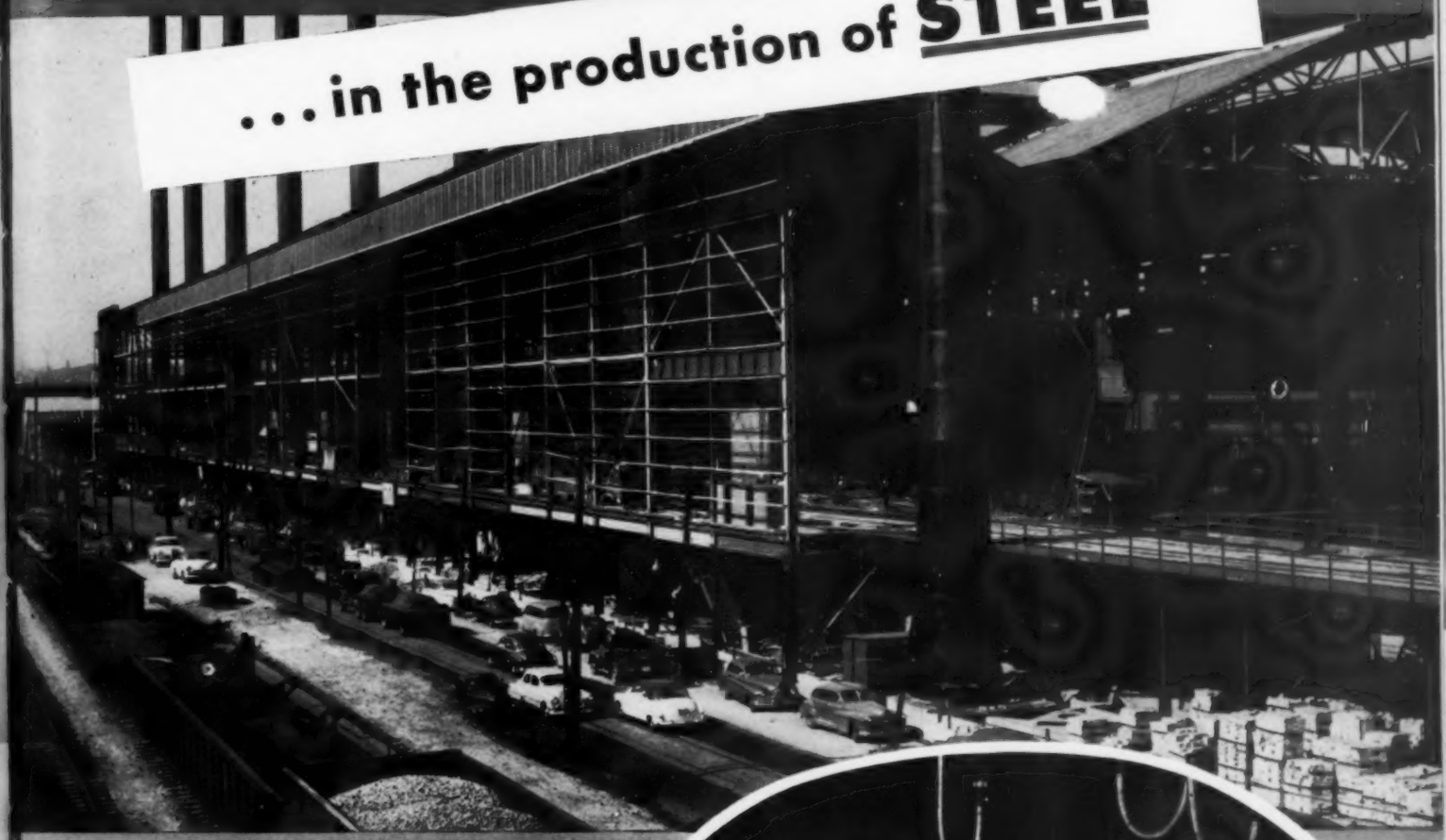
Power, Electrical, Processing Equipment for Iron and Steel

Engineers and constructors

SWINDELL

-DRESSLER

. . . in the production of STEEL



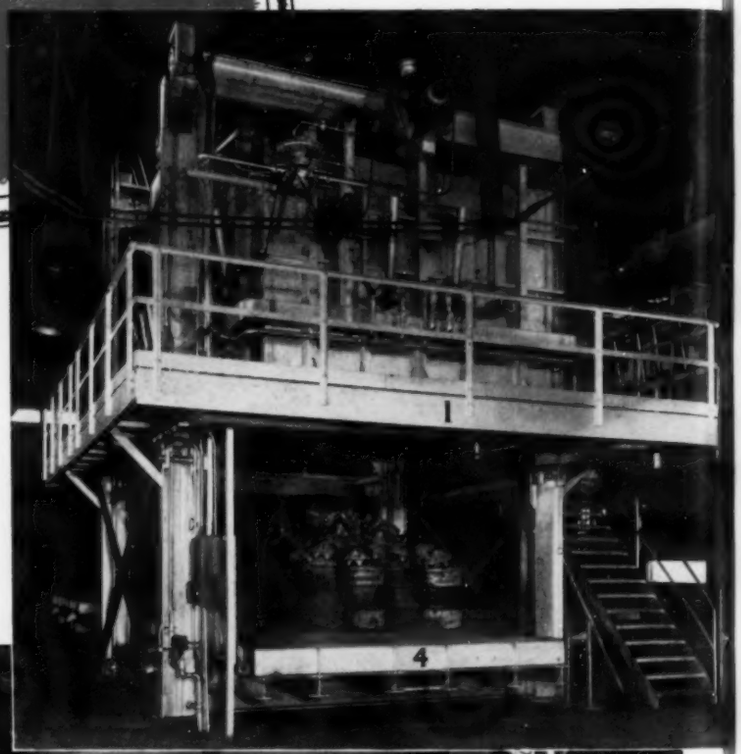
The engineering of steel-making facilities "from the ground up" is a major activity of Swindell-Dressler. • Whether the task is the construction of buildings and furnaces for a new electric melting shop (at left), or the engineering and management supervision of a gigantic open-hearth development in all its ramifications, Swindell-Dressler has the resources, the capacity and the experience for the job. • Let us discuss your coming requirements.

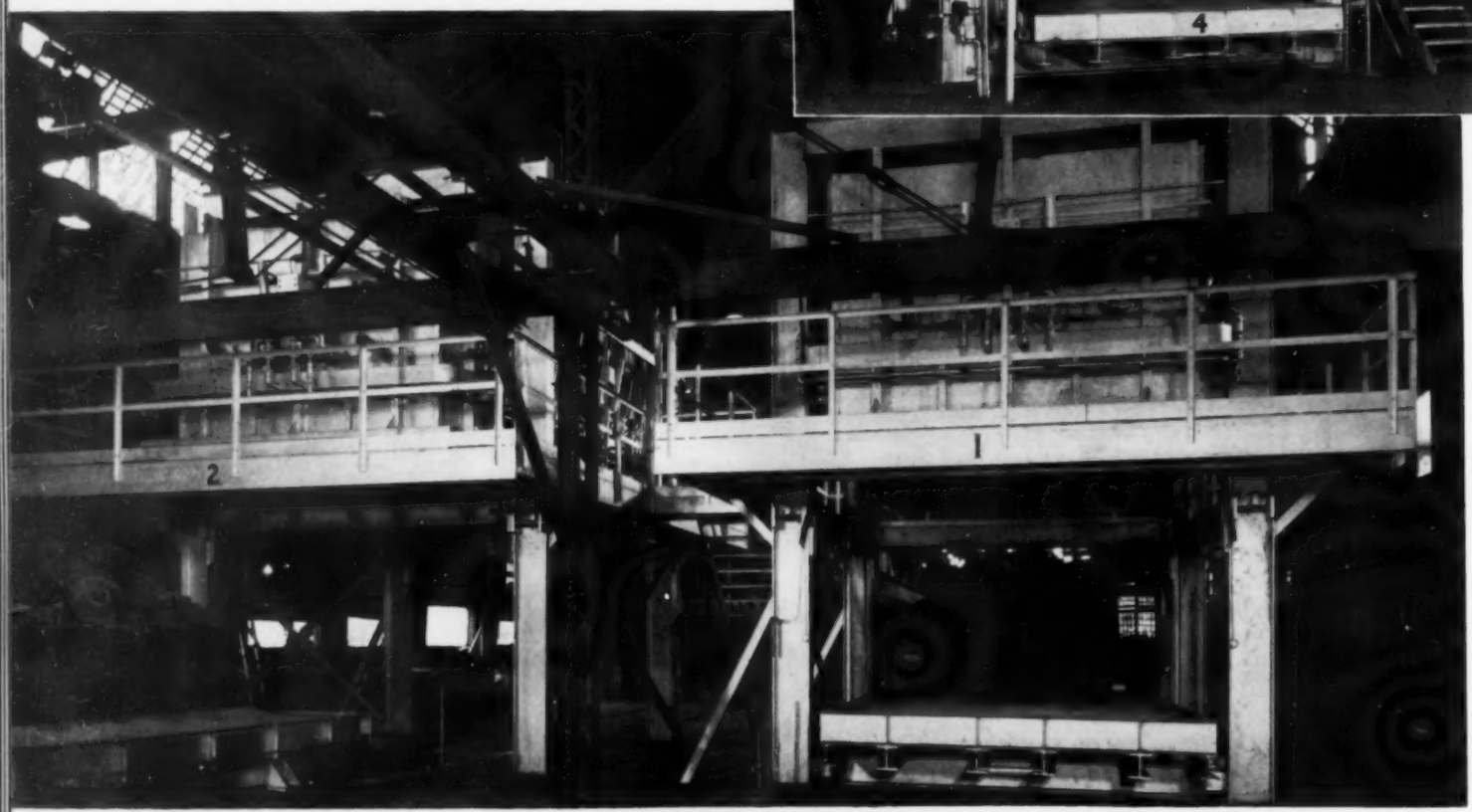
SWINDELL-DRESSLER *Corporation*

PITTSBURGH 30, PENNA.

WILSON MALLEABLEIZING FURNACES

THE two elevator type bell furnaces and four bases have just been installed in a large midwest malleable iron plant. Charge size: 76" x 220" - 66" high. Furnaces heated with "O" type radiant tubes.



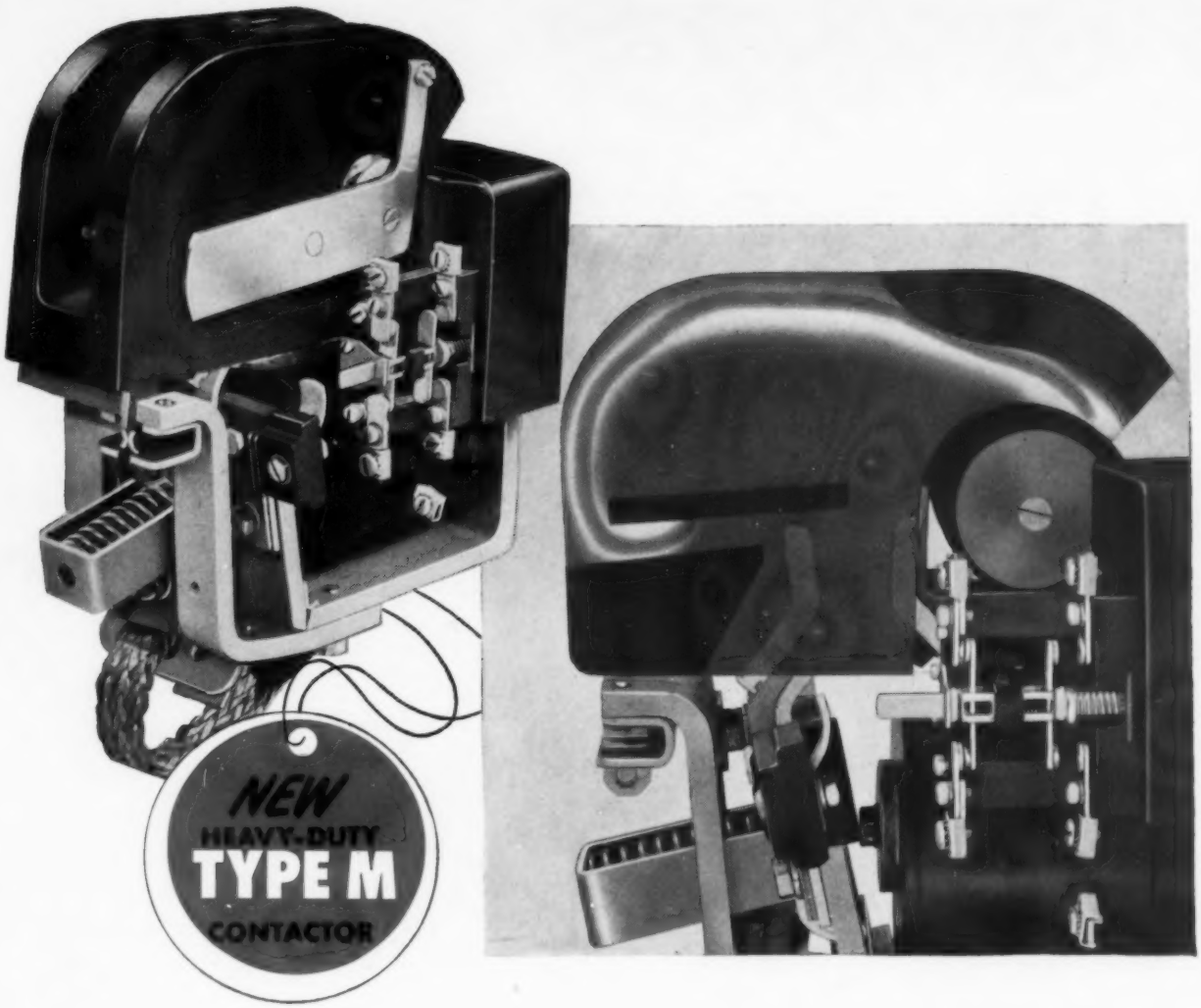


Lee Wilson ENGINEERING Co., Inc.

20005 WEST LAKE ROAD • CLEVELAND, OHIO

Telephone ED-1-6600

COIL TYPE FURNACES — RADIANT TUBE HEATING — ANNEALING PROCESSES



HOT ARCS STOPPED *COLD!*

When a d-c contactor opens under load, hot arcs leap between opening contacts. Burning with terrific heat, arcs bead and pit contact area—unless they are controlled and extinguished *quick.*

Arcs don't have a chance in the Westinghouse D-C Type M Contactor. In half a wink—less time than it takes contacts to open fully—the exclusive double-pocket, "Qwik-Quench" arc box with special side-plate design increases blowout flux density across the contacts . . . speeds the arc to the arc horns . . . and extinguishes it. Action is *fast.*

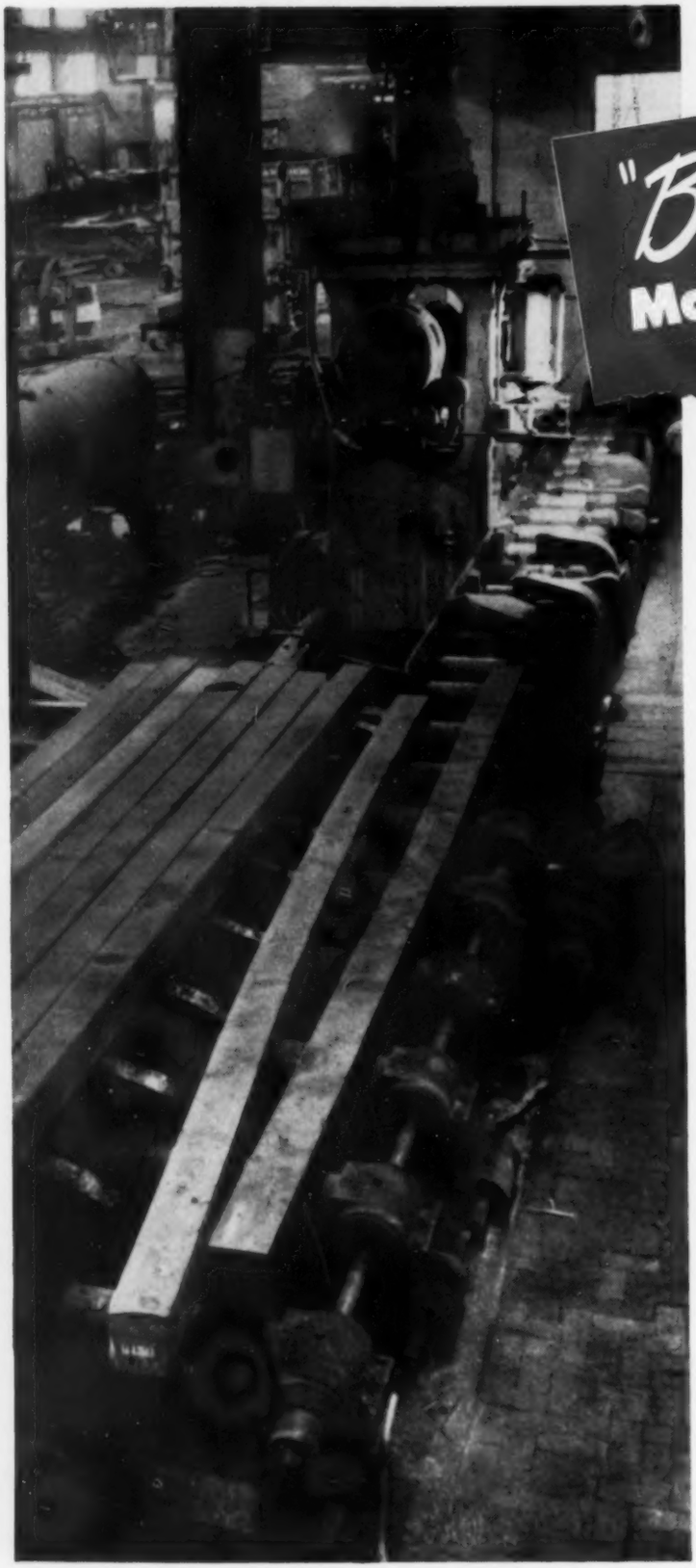
Result? Contacts stay clean . . . need less service . . . last longer . . . stand up to millions of make-breaks under heavy loads. Arc boxes last longer.

Fast arc quenching is but one feature of new Type M Contactor. Ask your Westinghouse representative to tell you about the unit construction . . . the self-cleaning knife-edge bearing . . . the unit-mounted interlocks, and other exclusive Type M features.

Call him today for a copy of B-5261 and the complete Type M story. Or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

J-27001-A

YOU CAN BE SURE...IF IT'S
Westinghouse
MOTORS and CONTROLS



"Billeteering" Modernization...

at ALAN WOOD STEEL COMPANY

Alan Wood Steel Company modernized billet cleaning 10 years ago when *a Bonnot Billeteer was installed.*

A revelation in accurate billet conditioning—with its almost completely automatic operation, finger touch control, speed and safety—the Billeteer has increased output, improved quality and reduced manpower turnover—eliminated the drudgery, dangers and delays of billet-cleaning by hand.

Modernization with "Billeteering" reflects the foresightedness—in keeping abreast of the times at all times—with which Alan Wood Steel Company enters the *second quarter of its second century in business.*

Engineered For Improved Production

The Bonnot Co.
STEEL EQUIPMENT DIVISION
CANTON 2, OHIO

Also Manufacturers of — SAWING • CRUSHING • PULVERIZING AND MIXING EQUIPMENT • BILLET INSPECTION TABLES
DUST PUG MILLS • SINTER PLANT PUG MILLS

UNITED 16" & 49" x 68"—4-High Sheet Mill

UNITED SHEET MILLS

UNITED mills of the type illustrated are widely used in the cold reduction of both ferrous and non-ferrous metals.

We are now building two similar mills for rolling stainless steel.

Designs of these new units are available for duplication; or they may be modified to suit your requirements.

Why not ask our engineers for further particulars.

UNITED ENGINEERING AND FOUNDRY COMPANY

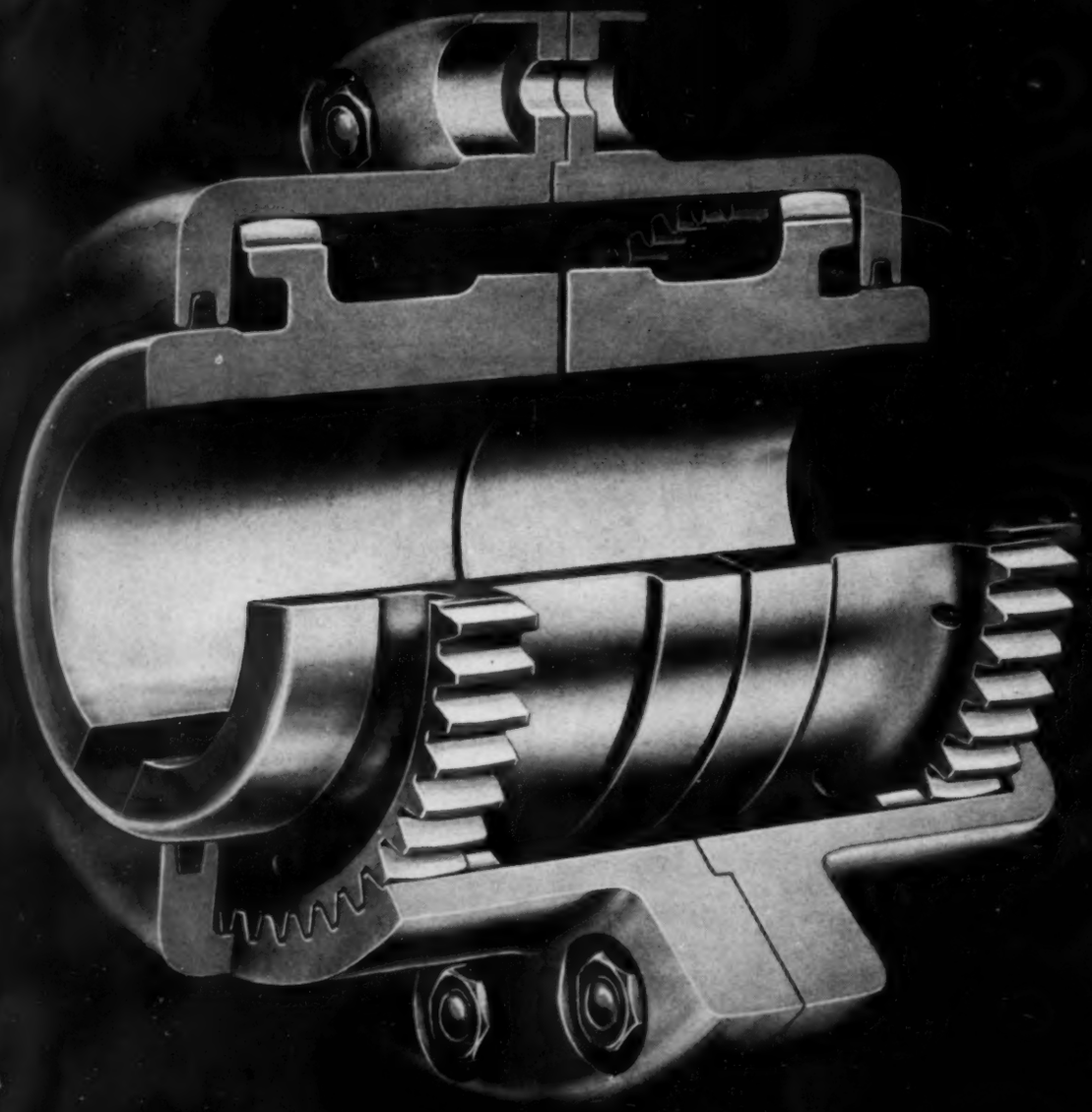
PITTSBURGH, PENNSYLVANIA

***Plants at* PITTSBURGH • VANDERGRIFT • NEW CASTLE • YOUNGSTOWN • CANTON**

Subsidiaries: Adamson United Company, Akron, Ohio
Lobdell United Company, Wilmington, Delaware
Stedman Foundry and Machine Co., Inc., Aurora, Indiana

Designers and Builders of Ferrous and Nonferrous Rolling Mills, Mill Rolls, Auxiliary Mill and Processing Equipment, Presses and other Heavy Machinery. Manufacturers of Iron, Nodular Iron and Steel Castings, and Weldments.

POOLE



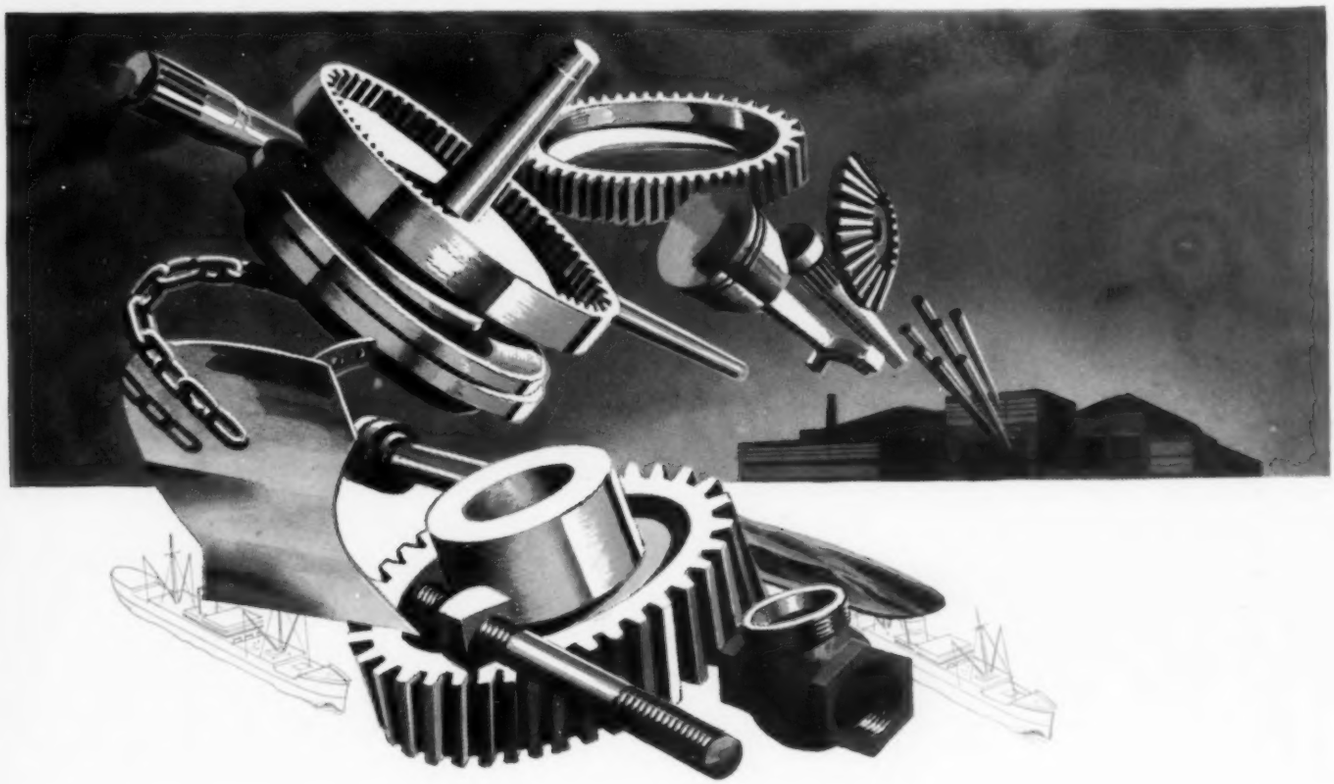
A COPY OF CATALOG GIVING FULL DESCRIPTION AND ENGINEERING DATA SENT UPON REQUEST.

FLEXIBLE COUPLINGS

POOLE FOUNDRY & MACHINE COMPANY

WOODBERRY, BALTIMORE, MD.

What's your rust prevention problem?



One of Gulf's Quality Rust Preventives can help you solve it

From the complete Gulf line of quality rust preventives, you can select the proper coatings to fit the desired methods of application, types of metal, length of time for which protection is required, conditions of storage or shipment, and ease of removal.

Gulf makes available both oil — and petrolatum-type rust preventives for both interior and exterior use — including the well-known Gulf No-Rust C (Polar Type), which displaces residual moisture on metal surfaces and lays down a protective coating; and Gulf No-Rust Engine Oils, which prevent corrosion caused by products of combustion left in internal combustion engines.

There's a Gulf rust preventive for every duty, for protection against all exposures. Send the coupon for copy of a pamphlet describing the principal rust preventives in the Gulf line. For effective help on your rust or corrosion problems, call in a Gulf Lubrication Engineer.

GULF SERVES INDUSTRY

Gulf Oil Corporation · Gulf Refining Company ISE
719 Gulf Building, Pittsburgh 30, Pa.

Please send me, without obligation, a copy of your pamphlet "Gulf Rust Preventives."

Name.....

Company.....

Title.....

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Vibrationless LIFTING POWER

300/60/20-TON, 4-GIRDER DOUBLE TROLLEY *Alliance* LADLE CRANE

● Building big cranes has been our business here at Alliance for more than 50 years. Whenever the industrial world has required cranes of large capacity, it has always found The Alliance Machine Company with designs and "know-how" to meet its requirements.

The 4-girder, double trolley ladle crane illustrated here was built for the Homestead Steel Works of the United States Steel Company to handle the increased Open Hearth capacity. It required a 4-story cage to house the electrical equipment to control the various motions of this crane. The three upper stories contain the magnetic control equipment and resistors. The bottom section of the cage houses the master controllers and the operator and is insulated.

This ladle crane is equipped with a two-motor, synchronized worm drive, interlocked double drum type main hoist. The synchronizing shaft employed in this scheme of gearing not only eliminates the undesirable ratchet gears but makes possible an additional safety feature in case one of the hoist motors fail. Under this condition both worms are driven by the remaining motor and all gearing functions as with two motors. In case of failure of one hoist motor on the conventional drive **without** the synchronizing shaft, hoisting is accomplished by **only one** set of gears. This imposes a double load on active gearing, the second drum being driven through the interlocking drum gears. The hoist gearing is so proportioned that the full capacity of the crane can be lifted by one motor without exceeding the quarter-hour rating.

The drum gears and pinions of the main hoist of this new crane have precision-cut, single-helical teeth, and in cooperation with the worm drive, assure vibrationless operation on either high or low speed hoisting and lowering.

All gears are fully enclosed and operate in a bath of oil, assuring long life and low maintenance.

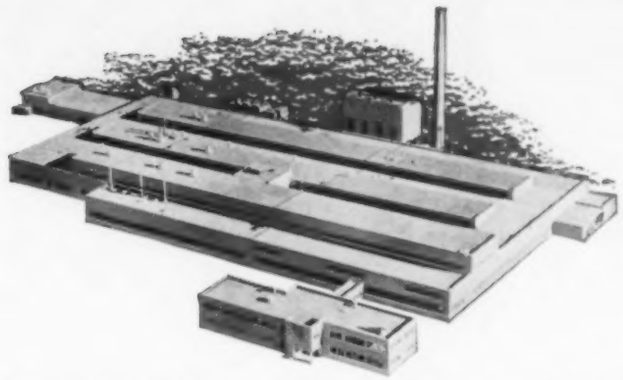
The 4-part safety rope system installed on this crane affords the highest degree of safety in rope reeving.

Why not consult The Alliance Machine Company engineers when you have heavy material handling problems?

THE ALLIANCE MACHINE COMPANY

MAIN OFFICE
ALLIANCE, OHIO · PITTSBURGH OFFICE
1622 OLIVER BUILDING, PITTSBURGH, PA.

LADLE CRANES • GANTRY CRANES • FORGING MANIPULATORS • SOAKING PIT CRANES • STRIPPER CRANES • SLAB AND BILLET CHARGING MACHINES • OPEN HEARTH CHARGING MACHINES • SPECIAL MILL MACHINERY • STRUCTURAL FABRICATION



N-B-M Meadville . . . where the welcome mat is out. We're proud of this plant—its equipment and the skilled people who work in it. Proud enough, in fact, to offer a standing invitation to Blast Furnace Superintendents or other steel mill officials to visit us. When can *you* make an inspection trip?

Tests that take nothing for granted

Here's the plant where you'll find that nothing is overlooked in maintaining control of copper casting quality

Another reason why N-B-M Meadville is a name to remember when you specify copper castings. It takes experience—plus the very finest facilities for molding, pouring, and machining—to produce uniformly sound copper castings. And, *it takes thorough quality control.*

The basic tests shown above are made on every copper casting produced at N-B-M Meadville . . . and only castings that pass these exhaustive tests reach the shipping room.

From the molding floor to the shipping room, N-B-M Meadville accomplishes what should be, and is, the main objective of this modern, well-manned plant . . . ***What you specify . . . we ship.***

AMERICAN Brake Shoe COMPANY

NATIONAL BEARING DIVISION

4936 Manchester Avenue • St. Louis 10, Mo.

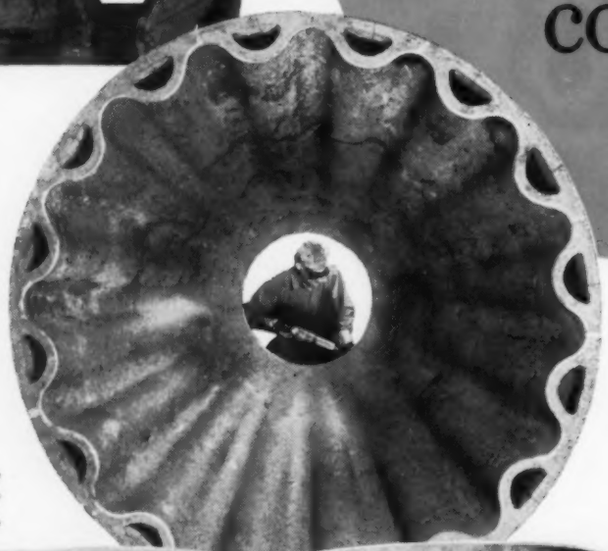
PLANTS IN: ST. LOUIS, MO • MEADVILLE, PA. • NILES, OHIO • PORTSMOUTH, VA. • ST. PAUL, MINN. • CHICAGO, ILL.

Johnston Cinder Pots, with curved sidewalls, are built so that there is no distortion in the critical heat zone—the middle third of the pot. Left pot is 400 cu. ft. capacity, right pot, 75 cu. ft.

Johnston Cinder Pots

decrease slag disposal costs

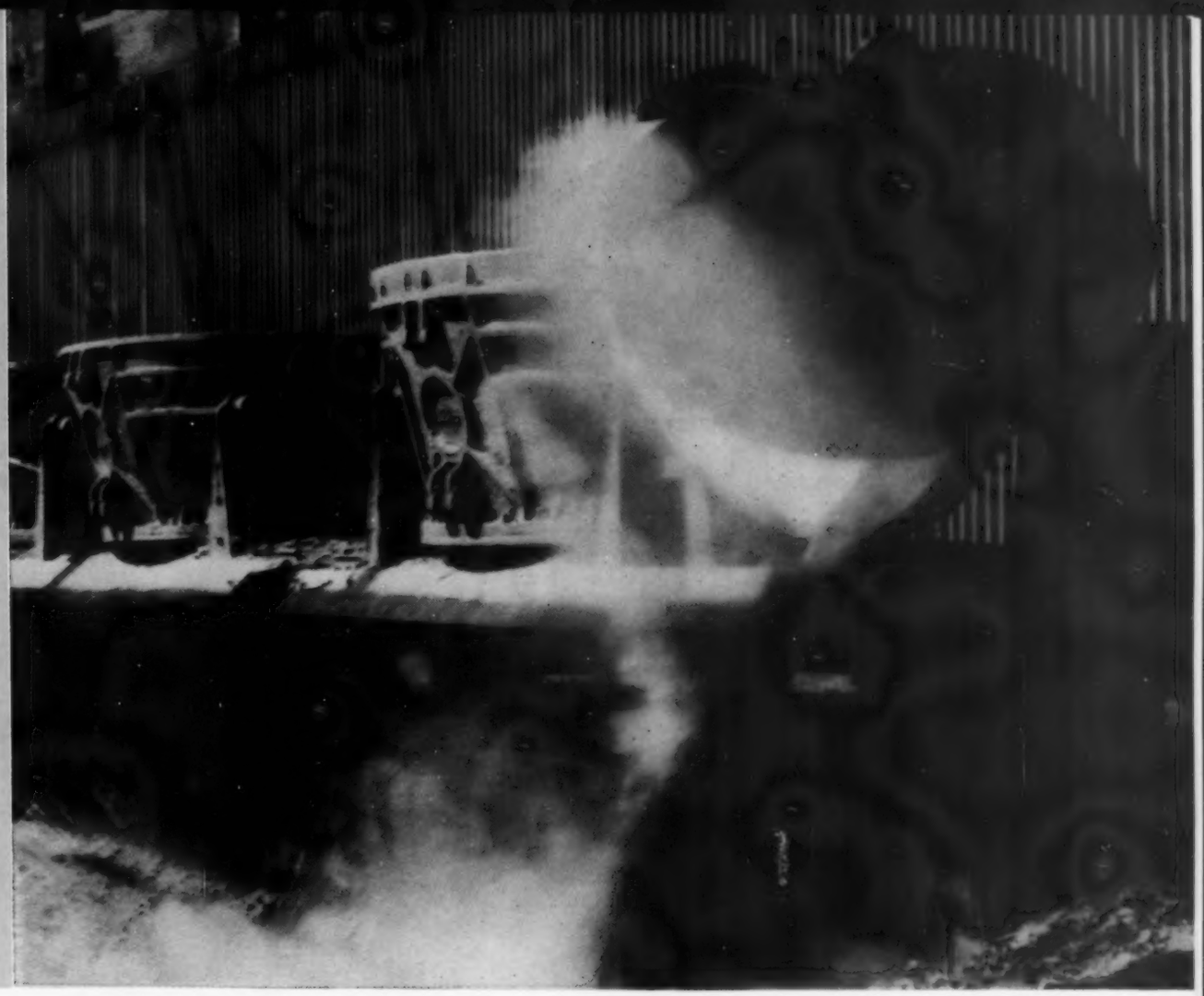
The long, useful life of Johnston Cinder Pots results from long application experience.



Corrugations provide maximum cooling surface area, help discharge skull without rapping.

Two 425 cu. ft. capacity oblong Johnston Cinder Pots mounted on dingey.

MACKINTOSH-HEMPHILL COMPANY
PITTSBURGH, U.S.A.



. . . because JOHNSTON CINDER POTS are engineered for increased heat-hours of service and faster turn-around time!

Performance records for Johnston Cinder Pots have been established in blast furnace and open hearth operations throughout the country, because Johnston Pots are designed for each job by experienced engineers. Here are two examples of how this engineering constantly improved Johnston Cinder Pot performance:

JOHNSTON CORRUGATED POTS with the expansible rim (400 cu. ft.) averaged 8,500 round trips in actual practice, against the expected 4,000 round trips at one plant.

MODERN, OBLONG, FLAT-BOTTOM POTS (designed to utilize existing tunnels) resulted in a 100% increase of capacity over older type pots.

FEATURES OF JOHNSTON CINDER POTS INCLUDE:

1. Expansible rims allow pots to retain shape under severe service conditions.
2. Corrugated walls permit rapid heat dissipation, and help eliminate firecracking and wall checking.
3. Patented construction prevents wall sag in slag-filled pots.
4. Johnston Pots are repairable if damaged in service.

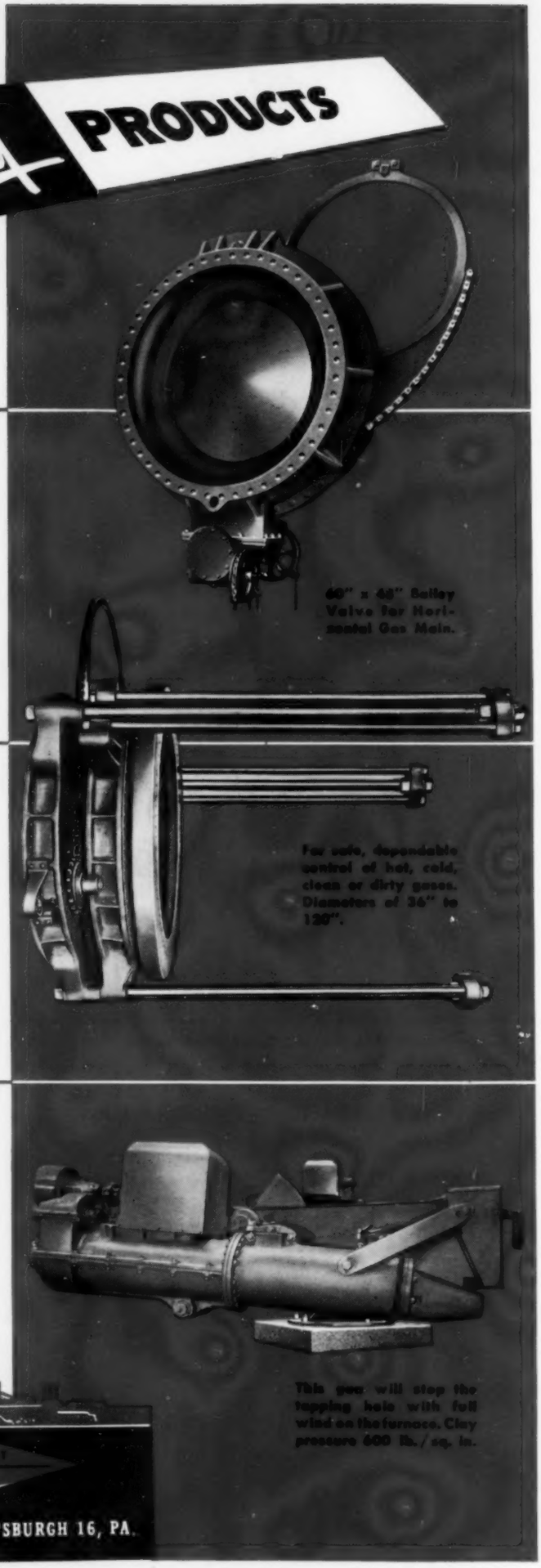
For maximum service, for minimum costs of slag disposal, check with Mack-Hemp. Johnston Slag Handling Equipment Specialists have had much experience in the design and production of Cinder Pots, a valuable background of information you'll find most useful. To keep up with the latest developments in Johnston Cinder Pots, watch what's new at Mack-Hemp.

MACKINTOSH-HEMPHILL COMPANY

PITTSBURGH & MIDLAND, PA.

MACKINTOSH-HEMPHILL PRODUCTS INCLUDE: rolls . . . steel and special alloy castings . . . completely integrated strip mills . . . heavy duty engine lathes . . . Mackintosh-Hemphill rotary straighteners . . . improved Johnston patented corrugated cinder pots and slag-handling equipment . . . shape straighteners . . . end-thrust bearings . . . shears . . . levellers.

These **dependable** Bailey PRODUCTS **contribute to STEEL MILL SAFETY**



Bailey MECHANICAL VALVES

Noted for their dependable operation under all conditions, Bailey Mechanical Goggle Valves provide a tight, positive seal for shutting off gas mains in emergencies or for repairs. Requiring a minimum of maintenance, they operate by a powerful clamping force which is applied equally at all points around the disc periphery. Regardless of time between operations, they open or close instantly. Sizes from 6″ to 72″, totally enclosed if desired.

60″ x 48″ Bailey Valve for Horizontal Gas Main.

Bailey THERMAL VALVES

Operated by the lineal expansion and contraction of three sets of tubes spaced around a rigid steel flange, the Bailey Thermal Valve is always safe, dependable and *ready*. When steam is passed through the tubes, thermal expansion creates a powerful force that instantly frees the goggle plate and permits valve operation. When the steam is removed, contraction closes the flanges against the plate, forming a tight seal. Can be operated by hand in case of steam failure.

For safe, dependable control of hot, cold, clean or dirty gases. Diameters of 36″ to 120″.

Bailey CLAY GUN

Powerful electric drive provides the piston pressure necessary to maintain long and uniform tapping holes. Special Bailey Lever Action forces the nose of the gun into position with positive accuracy. Piston is driven by an electric motor through reducing gears. The Bailey Clay Gun is dependable and safe.

This gun will stop the tapping hole with full wind on the furnace. Clay pressure 600 lb./sq. in.

WILLIAM M. Bailey COMPANY
ENGINEERS
1221 BANKSVILLE ROAD PITTSBURGH 16, PA.

The hard, cold facts about Pittsburgh's hot furnaces!

47 PLANTS OKAY THE HEAT PROVER

Pittsburgh's great steel industry needed an instrument to measure air infiltration, to check air requirement and fuel-air ratio controls in open-hearth furnaces . . . an instrument to check the stoves in which blast-furnace air is heated . . . to check precise atmospheres in soaking pits . . . to control fuel waste and precise atmospheres in processing furnaces.

THE CITIES SERVICE HEAT PROVER WAS THE ANSWER . . . and it received the stamp of approval from engineers in 47 different mills in and around Pittsburgh!

Cities Service Heat Provers . . . *not an instrument you buy, but a service we supply* . . . helped to boost furnace productivity through these five unique advantages:

1. Rapid continuous sampling.

2. Simultaneous reading of oxygen and combustibles.

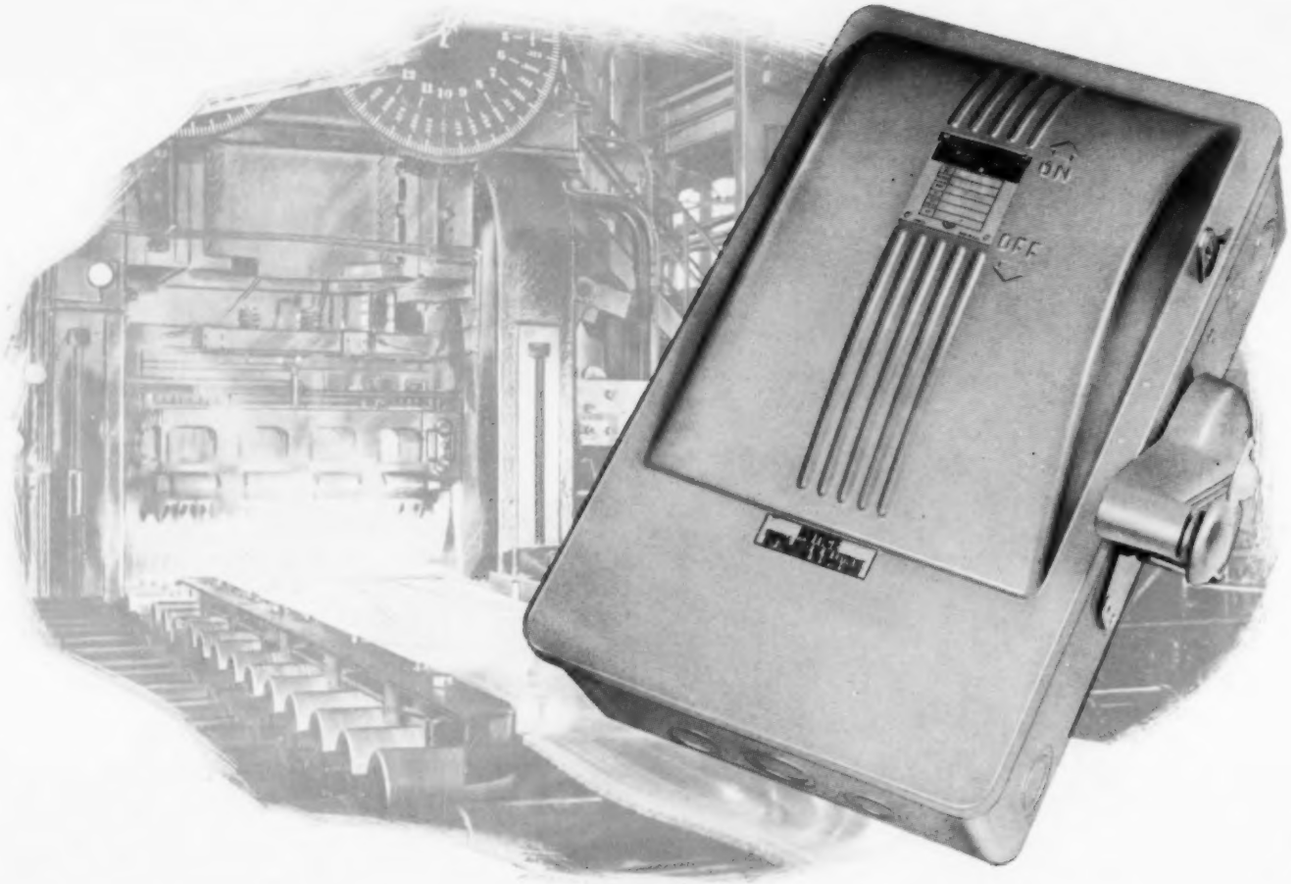
3. Direct measurement of oxygen and combustibles.

4. Easy portability.

5. No maintenance; no re-calibration.

These points begin to tell you why Cities Service Heat Prover analyses are just as much favored in glass, ceramics, steam generation and other fields as in the great Pittsburgh steel area. For the full story as it applies to you, write CITIES SERVICE OIL COMPANY, Dept. B-17, Sixty Wall Tower, New York City 5.

CITIES SERVICE



Less Outage...More Tonnage

with New *Life-Line* Safety Switch

Three shift circuit protection? Certainly—but only equipment with the stamina demanded by hard and frequent usage can give such protection.

The new Westinghouse Life-Line Safety Switch offers you more than ever before obtainable. In addition to basic simplicity of design, long-life giving features are diamond-pointed break jaws and extended blades to hold burning and beading outside contact area, and "De-ion®" Quenchers to knock out hot arcs. One-piece copper construction has fewer joints per pole, eliminating excessive internal heating.

Yes, protection—and with minimum attention. The proof? Front removable copper parts and base assembly, requiring only a screw driver, simplify maintenance and replacement. The base is of one-piece insulating composition, moisture-proof and resistant to carbonization and breakage. Wrap-around welded enclosure minimizes cabinet distortion. Self-aligning fuse-clip reinforcements assure constant contact pressure at all times.

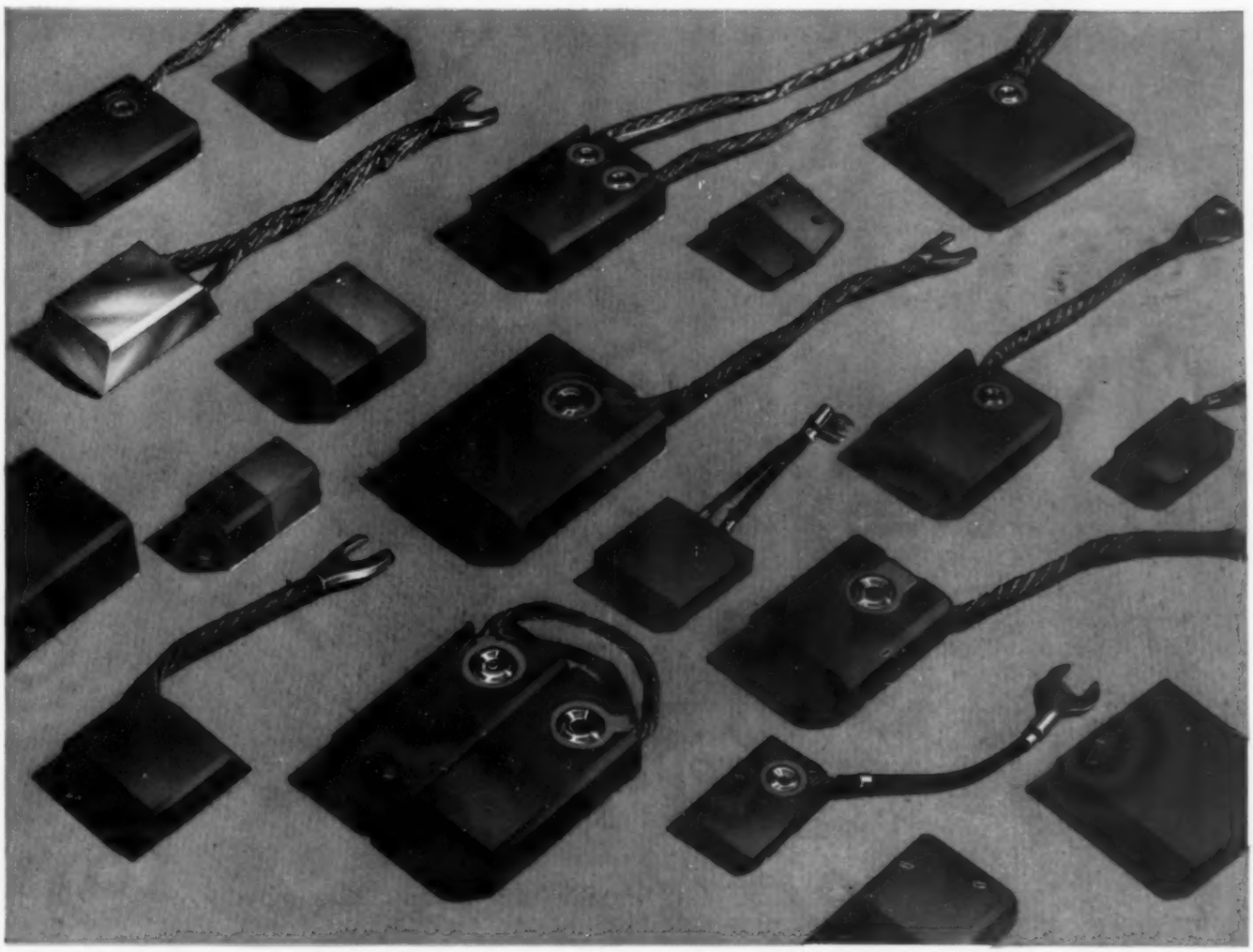
For further facts, contact your Westinghouse Distributor, or write for Booklet B-5457, Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania. J-30086

YOU CAN BE SURE...IF IT'S
Westinghouse
Life-Line
SAFETY SWITCHES

BUY USG BRUSHES

Try USG Brushes. They will solve those tough application problems for you. • Complete manufacturing facilities, plus continuous research and engineering make USG Brushes and Contacts the best you can use on all rotating electrical equipment. • USG BRUSHES can do a *better* job for you . . . Let us arrange a performance test to prove it.

Write today for 40-page catalog giving complete information on standard USG grades.

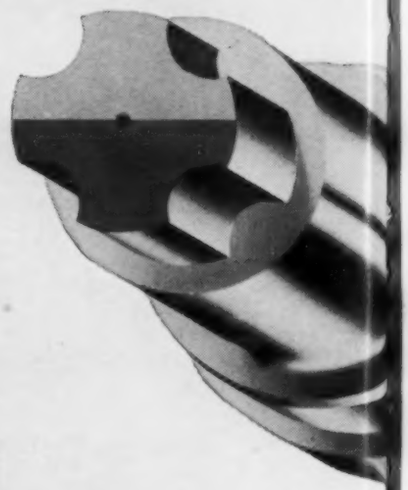


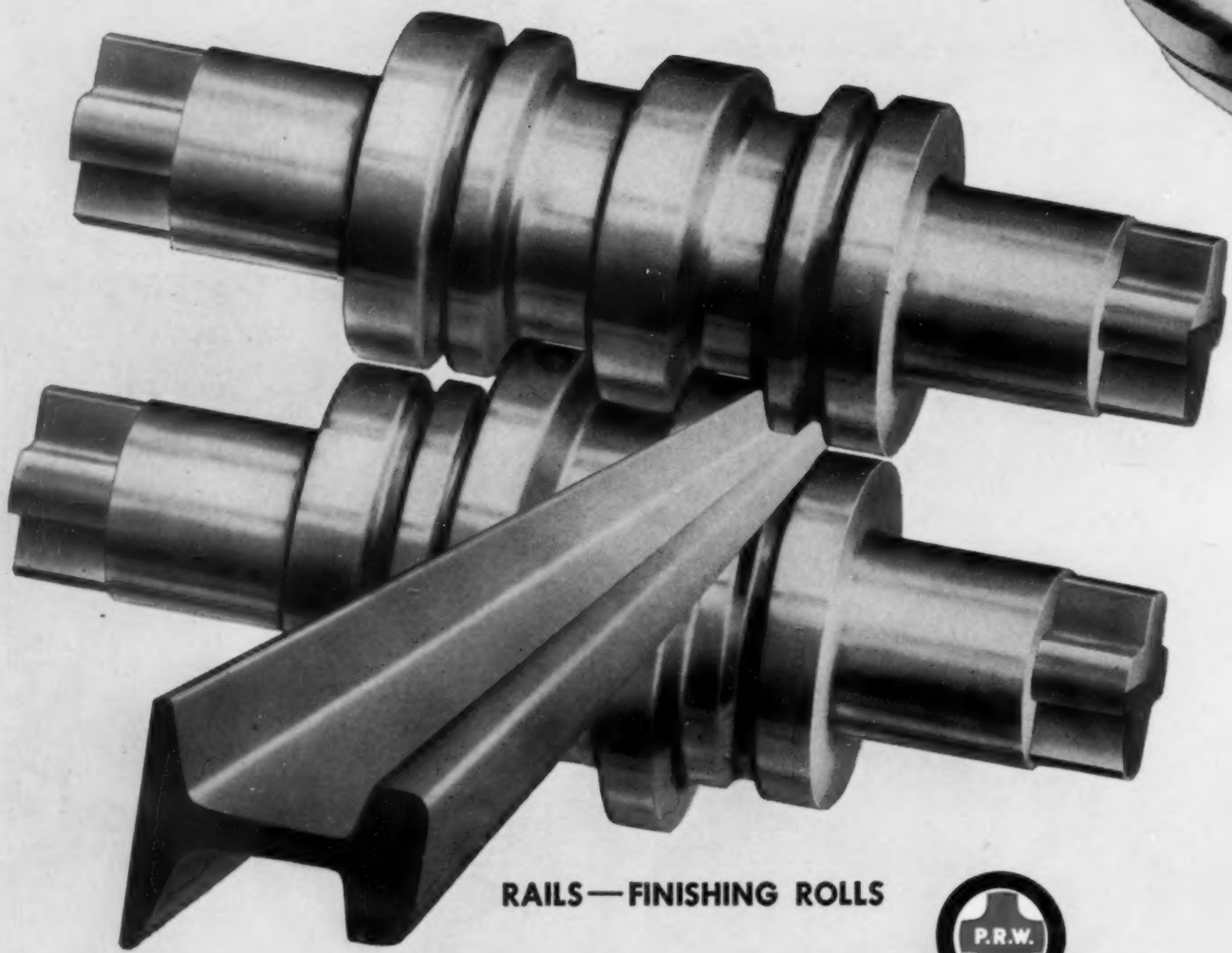
90-B

THE UNITED STATES GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION • SAGINAW, MICHIGAN

PHOENIX SPECIAL RAIL FINISHING ROLLS are color marked for a specific use in rolling...





RAILS—FINISHING ROLLS

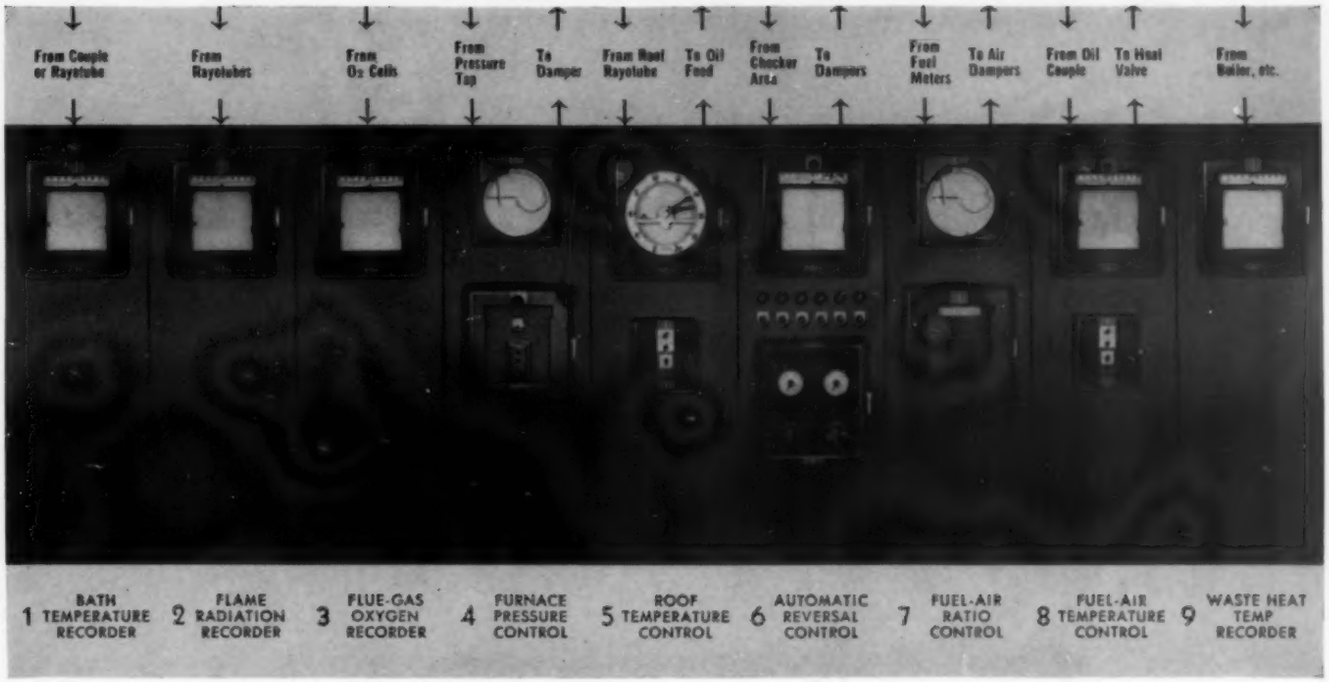
P.R.W.

PITTSBURGH ROLLS

PITTSBURGH ROLLS DIVISION of BLAW-KNOX COMPANY • PITTSBURGH, PA.

OTHER PITTSBURGH ROLL TYPES

CHILL	PHOENIX "K"
MOLY CHILL	PHOENIXLOY
PGH. GRADE 25	PHOENIX METAL
PGH. GRADE 35	PHOENIX METAL MASTER
PGH. GRADE 45	PHOENIX "A"
PGH. GRADE 55	CARBON STEEL
PGH. GRADE SPECIAL PROCESS	



HOW MANY OF THESE 9 OPEN-HEARTH HELPERS CAN YOU USE?

THE open-hearth instruments shown above are used for four principal reasons . . . either to increase production, improve quality, save money, or give information which helps in planning future improvements.

1. Bath Temperature Recorder gives information which helps increase production and raise quality. Either thermocouple or Rayotube types available. Bath measurements are rapidly becoming standard practice in progressive mills and foundries.

2. Flame Radiation Recorder is a fuel engineer's research tool. Gives facts not otherwise available.

3. Oxygen Recorder saves fuel by showing combustion efficiency . . . regardless of stage of process or type of fuel. An "advanced" instrument well worth investigation by qualified engineers.

4. Furnace Pressure Control saves fuel by holding products of combustion in furnace for proper time and by helping smooth out the heating of checkers; lengthens refractory life by regulating air infiltration.

5. Roof Temperature Control speeds production by making it safe and easy to hold furnace continuously at maximum temperature; saves fuel and refractory, too.

6. Automatic Reversal Control often leads the parade for its combination of labor saving, checker saving, fuel saving, and general process improvement.

7. Fuel-air Ratio Control and related equipment is exactly what's needed for high-production heating speed and fuel efficiency when an open-hearth furnace burns a mixture of fuels, or switches fuels frequently.

8. Fuel Oil Temperature Control maintains correct viscosity of oil and therefore helps maintain even burner action and correct combustion.

9. Waste-heat Boiler-temp Recorder gives information for efficient combustion and proper boiler operation.

Send Coupon For Further Facts

LEEDS & NORTHRUP CO.

Electrical Measuring Instruments — Automatic Controls
Telemeters — Heat-Treating Furnaces

Jrl Ad N-643(1)

LEEDS & NORTHRUP CO.
4942 Stenton Ave., Phila. 44, Pa.

I am interested in the items checked:

- ☐ Bath Temp. Rec.
- ☐ Flame Rad. Rec.
- ☐ O_2 in Flue Gas
- ☐ Furnace Press. Con.
- ☐ Roof Temp. Con.
- ☐ Auto. Reversal
- ☐ Fuel-Air Con.
- ☐ Fuel Temp. Con.
- ☐ Waste-heat Temp. Rec.

_____

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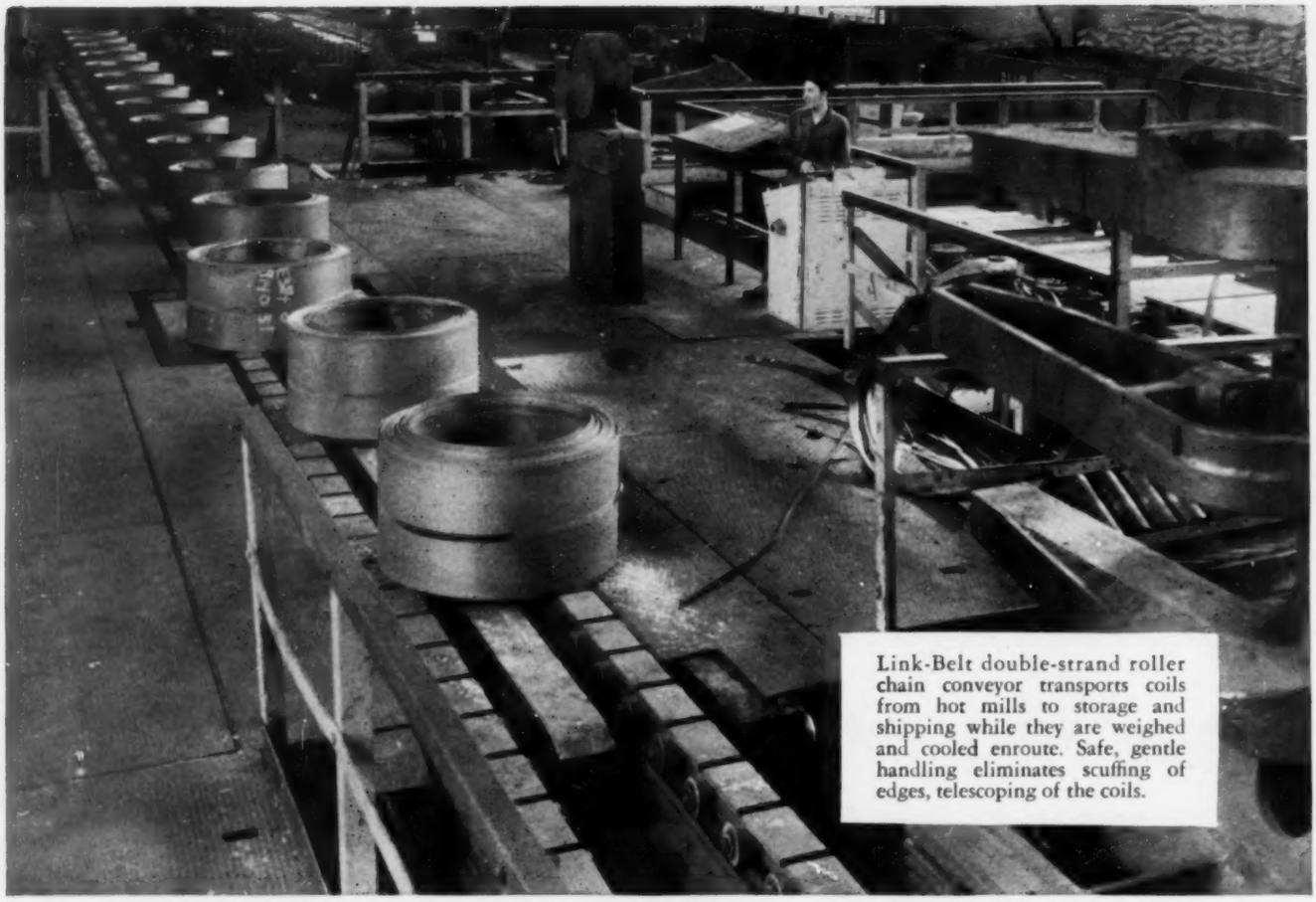


Link-Belt double-strand roller chain conveyor transports coils from hot mills to storage and shipping while they are weighed and cooled enroute. Safe, gentle handling eliminates scuffing of edges, telescoping of the coils.

MOVE up to 75,000 lb. COILS . . .

and get less scrap loss, greater safety

Yield goes up . . . waste goes down . . . with LINK-BELT Coil Handling Equipment

EVER-increasing rolling mill capacity and the trend toward larger coils require heavier conveyor systems capable of handling greater tonnages.

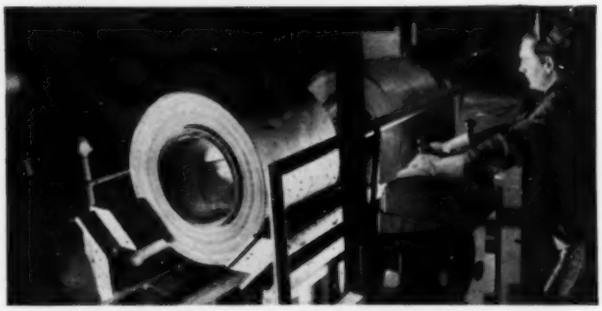
Since the inception of the continuous strip mill, Link-Belt has pioneered coil handling equipment. Now America's steel mills can choose from three basic Link-Belt conveyor types . . . designed to cover the complete range of operating needs.

Our engineers will work with your own engineers, consultants and builders of mill and process equipment. If you are contemplating expansion, it will pay you to call your nearest Link-Belt representative.

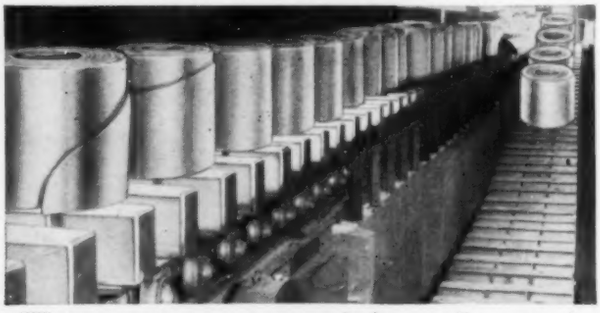
LINK-BELT

MATERIALS HANDLING, PROCESSING and POWER TRANSMISSION MACHINERY

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Cleveland 15, Pittsburgh 13, Atlanta, Dallas 1, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Offices in principal cities. 12.417-R



Coils are lifted clear of the Link-Belt heavy-duty pallet conveyor for automatic weighing at entry end of continuous pickle line. Other Link-Belt conveyors are designed for handling coils up to 75,000 pounds each.



Where numerous turns are required or cooling space is limited, Link-Belt Car-Type Conveyors are best. Coil never leaves its car. Without rolling or scuffing of edges, coils go around corners, up and down inclines.

CRANES . . . FOR THE STEEL MILL

All that Steel Mills demand in their cranes, "Shaw-Box" provides in fullest measure — trouble-free operation, stamina, dependability, sound design and engineering, maintenance convenience, and operating economy. Product of long experience in pioneering, developing, and manufacturing overhead electric traveling cranes to precision standards, each "Shaw-Box" Steel Mill Crane is an outstanding example of how completely individual mill and A.I.S.E. specifications can be interpreted. Skilled craftsmanship, advanced manufacturing techniques, and modern engineering practices are combined to produce simple, rugged Steel Mill Cranes at attractive prices!

An intimate understanding of mill requirements, gained through long years of working with the men of the steel industry, has made the building of Steel Mill Cranes an important part of "Shaw-Box" production. Their reliable low-cost performance, with minimum attention, is being clearly demonstrated in mills all over the country.

Summed up, the advantages of "Shaw-Box" design and manufacture are economical, top-quality cranes that deliver continuous service under the most severe operating conditions. They can be yours, at no extra cost!

BE SURE TO SEND ALL YOUR INQUIRIES FOR STEEL MILL CRANES AND SOAKING PIT CARRIAGES TO "SHAW-BOX."

SHAW-BOX CRANES

MANNING, MAXWELL & MOORE, INC. MUSKEGON, MICHIGAN

Builders of "Shaw-Box" Cranes, 'Budgit' and 'Load-Lifter' Hoists and other lifting specialties. Makers of 'Ashcroft' Gauges, 'Hancock' Valves, 'Consolidated' Safety and Relief Valves, and 'American' Industrial Instruments.

THERMIT WELDING
Speeds PUNCH to Steam Hammer

Serious losses in production threatened a large mid-western forging company, due to long delays in obtaining forgings the size of a complete 35,000 lb. ram. It was, therefore, decided to manufacture the ram for a steam hammer by joining two smaller forgings with Thermit Welding (Fig. 1) . . . a job which took only two weeks. The fabricated ram has seen many months of severe service (Fig. 2), and based on its excellent record, others are being built in the same way.

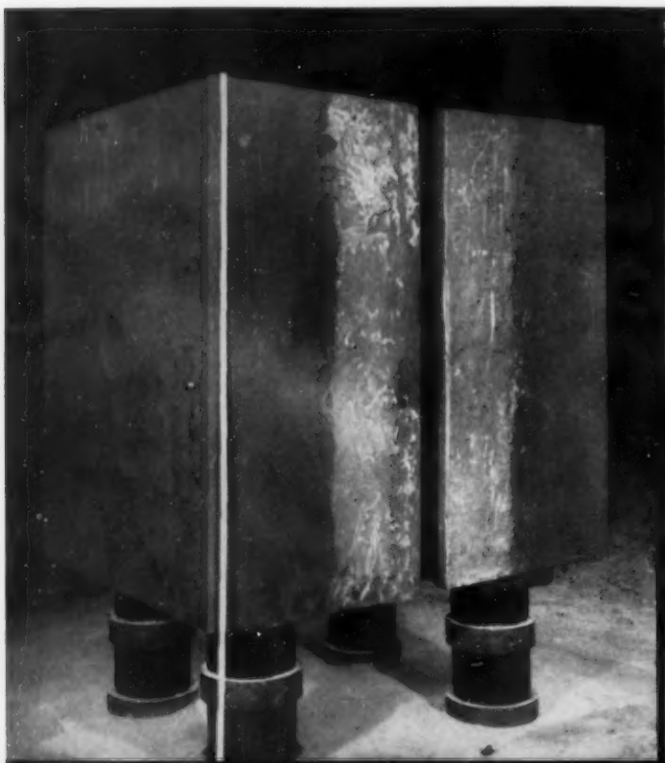


Fig. 1—Two forgings for ram in position prior to Thermit Welding.

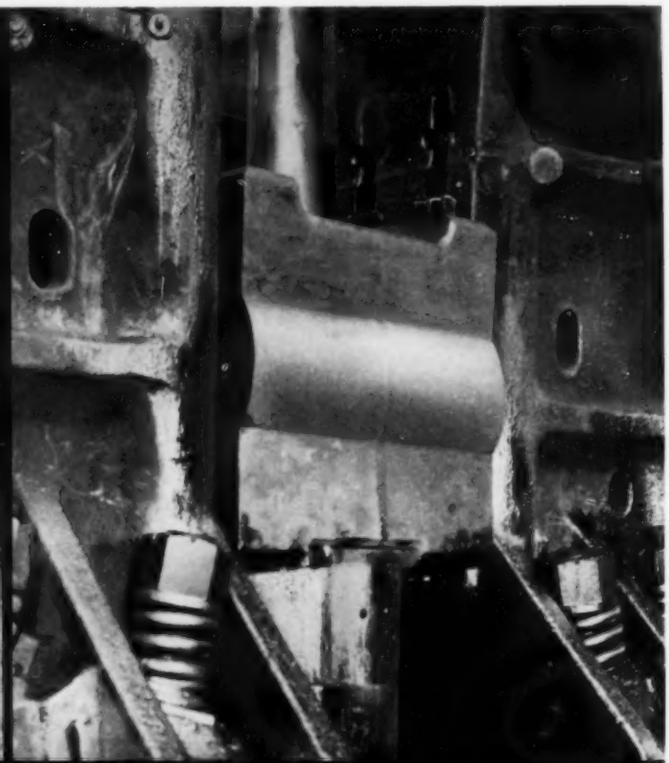


Fig. 2—Finished 35,000 lb. ram after fabrication by Thermit method.

CONSISTENTLY SOUND WELDS . . . MINIMUM OF TECHNICAL SKILL NEEDED . . . SPEEDY REPAIRS . . . LOWER THAN REPLACEMENT COSTS—four hard-hitting reasons for the swing to Thermit Welding in the repair, manufacture and maintenance of heavy drop forge industry equipment. Contact M&T on how Thermit Welding can help you!

THERMIT WELDING

METAL & THERMIT CORPORATION

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use dependable HAGAN

Ring Balance Flow Meters

to measure flow of

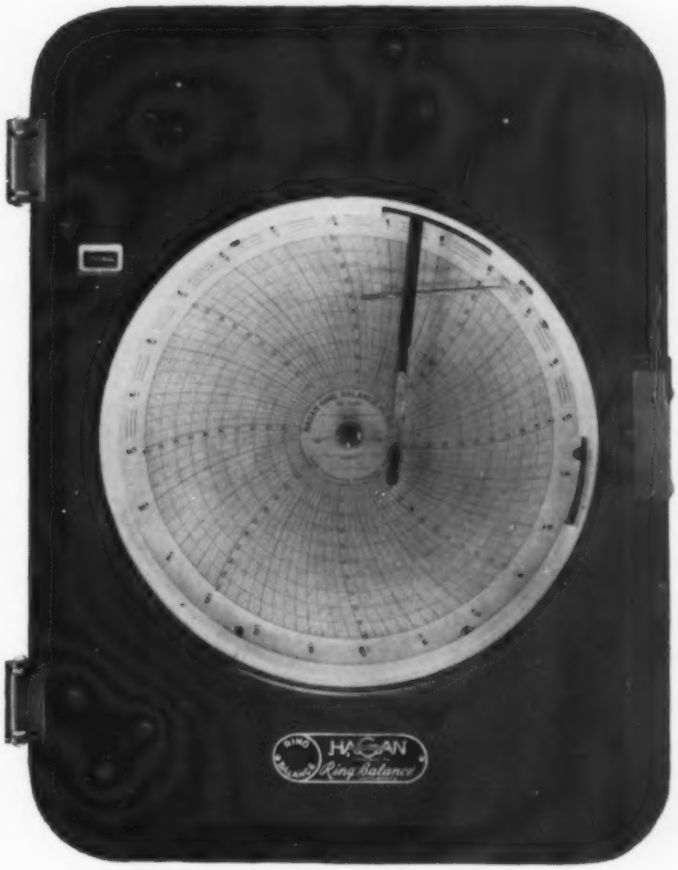
water–gas–
steam–oil–
air–other fluids

There are many reasons why you get dependable records when you use Hagan Ring Balance Flow Meters.

These include the unique ring torque resistance system which not only makes it possible to meter low flows reliably, but also provides an integral and convenient means for altering the meter capacity to any value over a 3½ to 1 range. Range changing is further simplified by a dead weight method of calibration. Other features include:

- No stuffing boxes
- Adjustable full scale range
- High sensitivity at low flow rates
- Mercury level not critical

Dependable pressure and temperature compensation (either or both) can be furnished with all Hagan Ring Balance Flow Meters.



An economical feature of all Hagan Ring Balance Meters is that maintenance costs are low. For other information on how versatile Hagan Ring Balance Flow Meters will answer your metering problems, clip the coupon, or write.

HAGAN CORPORATION

HAGAN BUILDING

PITTSBURGH 30, PA.

Ring Balance Flow and Pressure Instruments
ThrusTorq Force Measuring Devices
Boiler Combustion Control Systems
Metallurgical Furnace Control Systems

Hagan Corporation
Hagan Building
Pittsburgh 30, Pennsylvania

Please send me further information on Hagan Ring Balance Meters.

I am particularly interested in.....

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NAME.....

POSITION.....

COMPANY.....

STREET AND NUMBER.....

CITY.....ZONE...STATE.....

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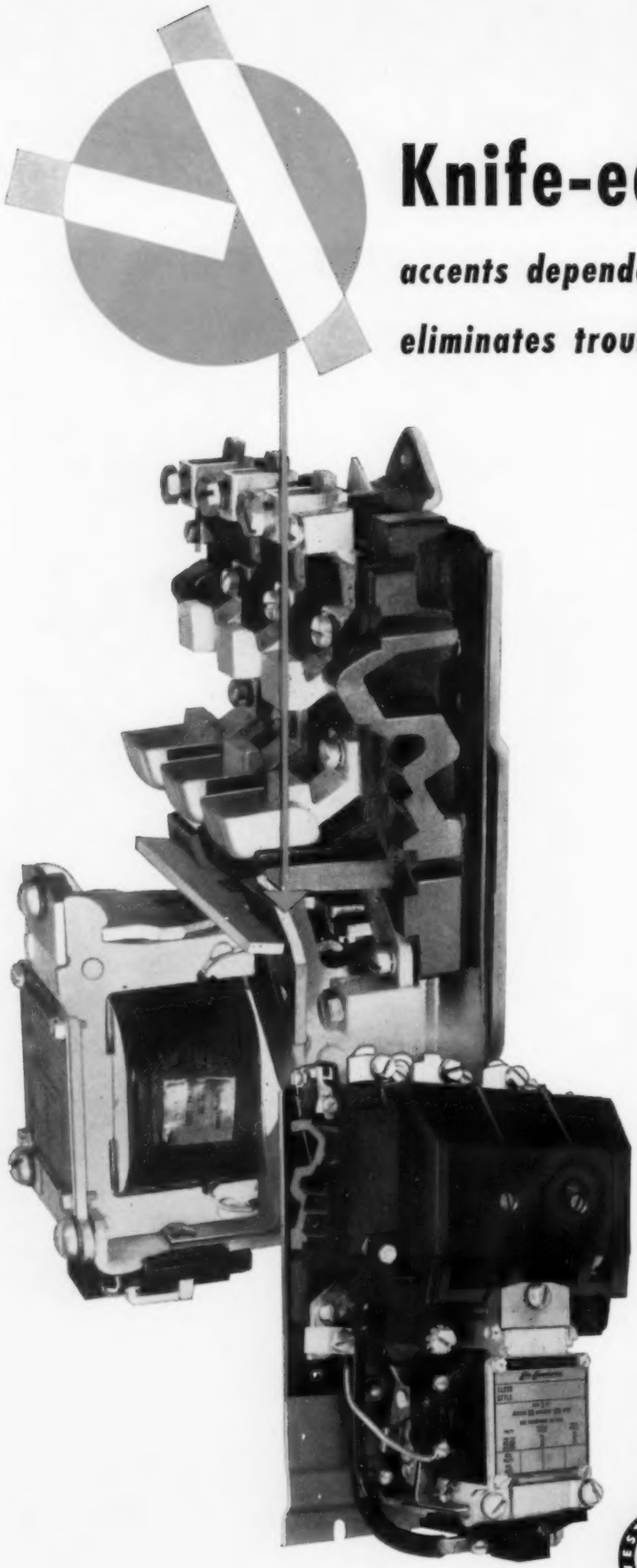


Knife-edge Action . . .

accents dependability

eliminates trouble

in A-C "NR Contactors"

Long, trouble-free, dependable service . . . with Westinghouse NR Contactors!

Here you have a contact closing arrangement designed with fewer moving parts! The entire contact assembly pivots on a knife-edge of specially hardened steel. As a result . . . no sliding surfaces to bind or wear . . . no misalignment troubles. Friction is at a minimum! Jamming and sticking are eliminated! Nothing need be lubricated!

NR Contactors perform accurately. Positive-action, kick-out springs give sure contact openings—independent of gravity. You've got full protection against false operation from vibration or accidental impact.

The contact is double break, spring loaded, tipped with silver . . . which means constant high conductivity . . . no need for filing, dressing or cleaning. Westinghouse-developed "De-ion®" Arc Chamber snuffs out the arc in half cycle or less, thereby minimizing contact damage.

Yes, you get superior performance for any contactor application with Westinghouse NR Contactors.

Learn many other features and the performance story of these NR Contactors by asking your Westinghouse representative or writing directly to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21678

YOU CAN BE SURE... IF IT'S Westinghouse

CONTROLS

space-saver *

*Here is a prime example of Salem-Brosius' broad service to the metalworking industry in the field of equipment manufacture and industrial furnace design. It's the exclusive Auto-Floor Forging Manipulator manufactured by the Brosius Division. One of its most valuable assets is its inherent capacity for saving space on a busy forging floor. No matter where hammers, presses or heating furnaces may be placed, this remarkably mobile machine can reach them with independent agility without freezing floor space with tracks or the overhead with craneways. It has even been found that new facilities can be added without additional building construction. If you have a problem which involves the use of heating furnaces, blast furnace equipment, or charging and manipulating machines—simply call on highly diversified Salem-Brosius today.

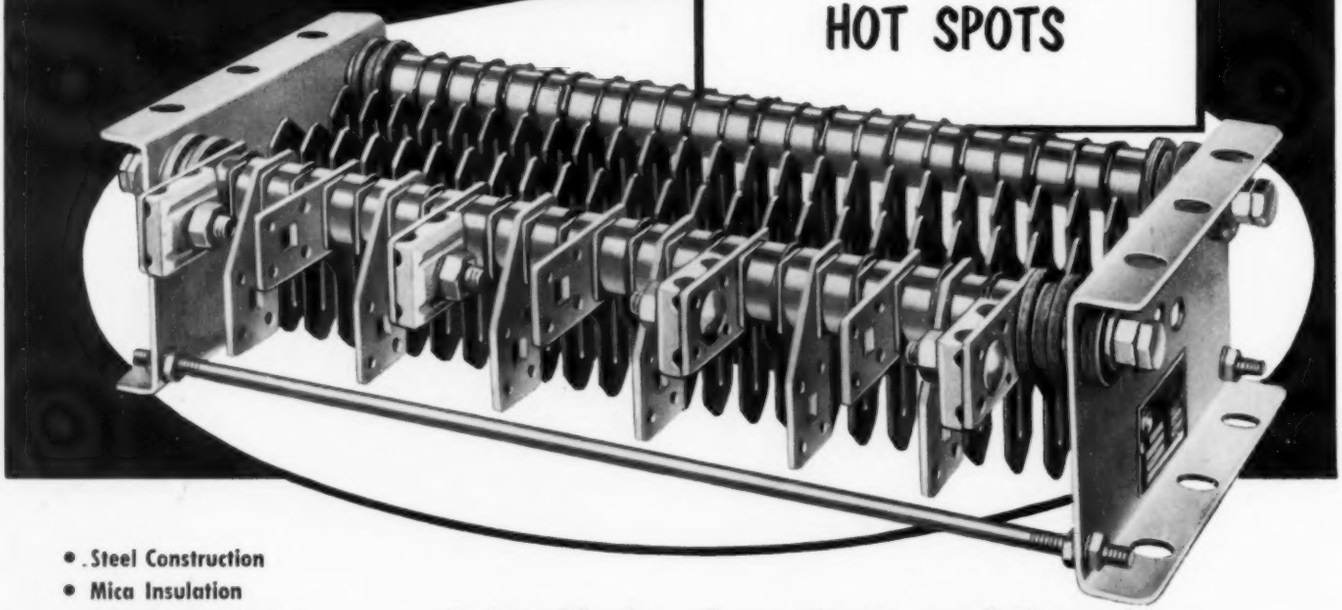
SALEM-BROSIUS, INC.

BROSIUS DIVISION, PITTSBURGH 15, PA.

SALEM ENGINEERING DIVISION, SALEM, OHIO

Resistor life depends on adequate ventilation.....

Patented P-G Grid Design eliminates HOT SPOTS



- Steel Construction
- Mica Insulation
- Corrosion Resistant
- Vibration Proof
- Moisture Resistant
- Provision for Expansion
- Adequate Ventilation
- Rugged Terminals

Write for Bulletin No. 500

Resistor life depends on adequate ventilation and how efficiently heat may be dissipated . . . P-G grid design equalizes the amount of air space surrounding each leg or loop to obtain even heat throughout the grid area. (Note illustration.) . . . Since heat is rapidly and evenly dissipated, hot spots fail to develop and longer resistor life is assured . . . For a nonbreakable resistor (only steel and mica used) specify P-G on your next application.

P-G

The Nonbreakable Steel Grid Resistor

THE POST-GLOVER ELECTRIC COMPANY

• ESTABLISHED 1892 •

221 WEST THIRD STREET, CINCINNATI 2, OHIO

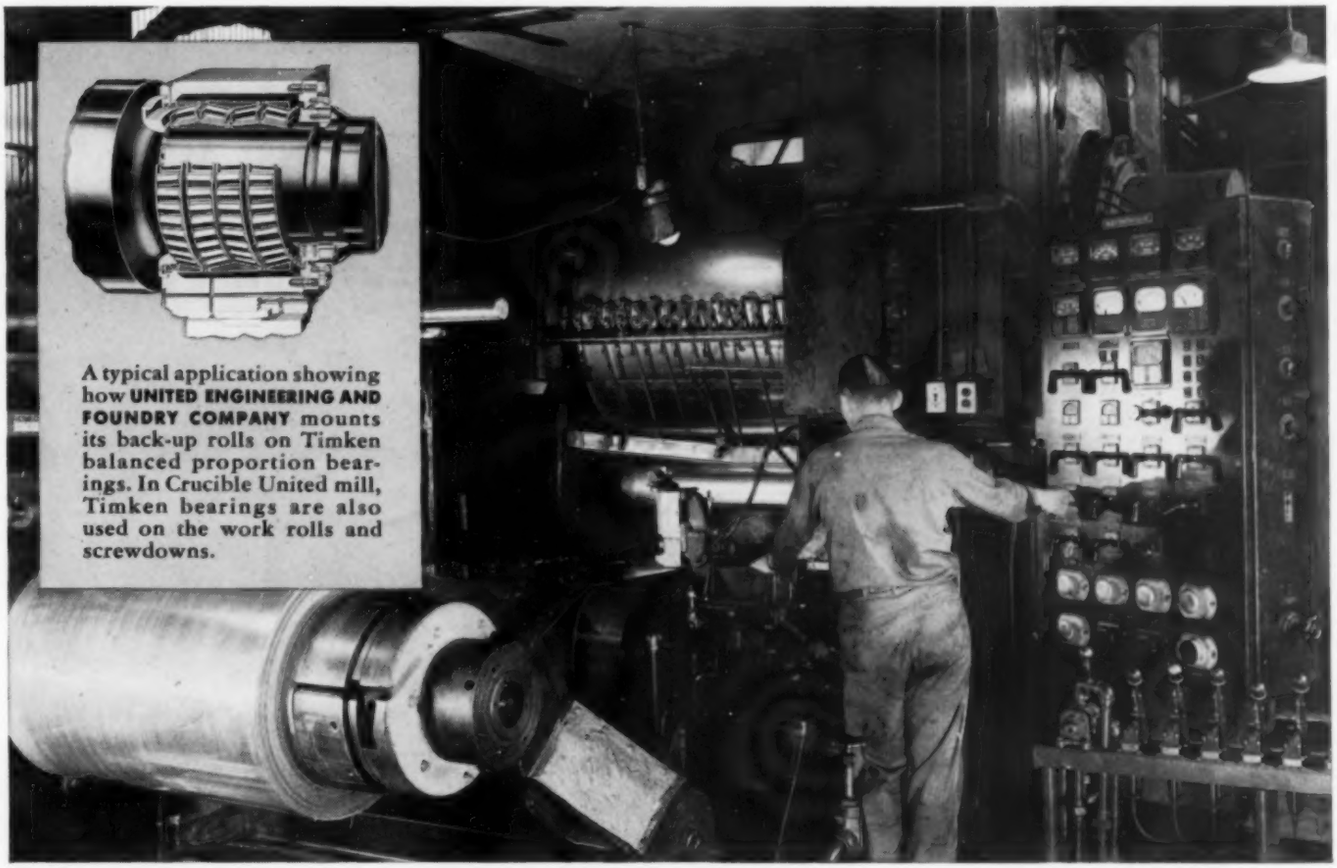
How TIMKEN® bearings back up a back-up roll

THIS United 54" four-high reversing mill is rolling 38½" wide sheet type 302 stainless steel at Crucible Steel Company's Midland, Pa., plant. To help it stay on the job day after day—with a minimum time-out for maintenance and repair—its back-up rolls are mounted on Timken® balanced proportion bearings. Timken balanced proportion bearings on the back-up rolls provide greater mill rigidity because they permit larger diameter roll necks than standard roller bearings. Load ratings are increased up to 40%, roll neck strength upped 50 to 60%.

Timken bearings on work rolls and back-up rolls eliminate complicated lubrication systems, permit the use of simple and economical grease lubrication. Rolls can be changed quickly and easily. No special thrust bearings are needed because Timken bearings take radial and thrust loads in any combination. And due to their true-rolling motion, and incredibly smooth surface finish, Timken bearings reduce roll neck friction. Smoother starts and stops of mills on Timken bearings prevent the loss of steel.

Over 50 years of bearing research and development have made Timken bearings first choice throughout industry. Specify them for roll necks on new and existing equipment. For full information consult our roll neck bearing specialists. Write The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



A typical application showing how **UNITED ENGINEERING AND FOUNDRY COMPANY** mounts its back-up rolls on Timken balanced proportion bearings. In Crucible United mill, Timken bearings are also used on the work rolls and screwdowns.

FINISHED TO CLOSER TOLERANCES

Finishing to incredible smoothness accounts for much of the precise, smooth rolling performance of Timken bearings. This honing operation is typical of the amazingly accurate manufacturing methods at the Timken Company.

The Timken Company is the acknowledged leader in: 1. advanced design; 2. precision manufacturing; 3. rigid quality control; 4. special analysis steels.

TIMKEN

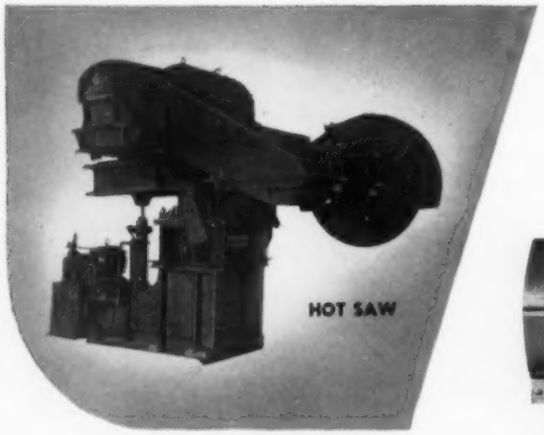
TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

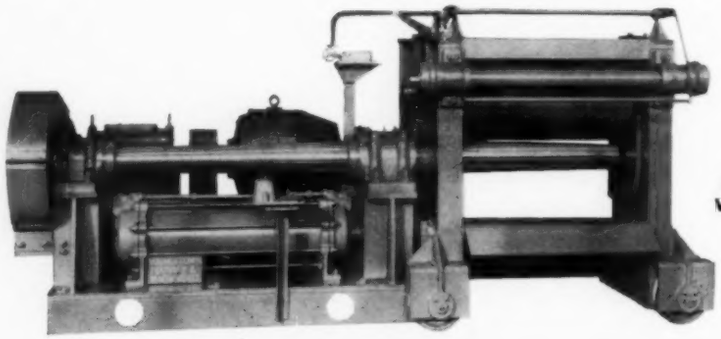
NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ◎ AND THRUST →◎← LOADS OR ANY COMBINATION ✳

F&Ym BUILDS *MODERN MILL EQUIPMENT*

designed to do a better job



HOT SAW



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- HYDRAULIC SLAB AND BILLET PILERS
- STRIP AND SHEET OILING EQUIPMENT
- SHEET SCRUBBER AND CLEANING LINES
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- BILLET EJECTORS—PINCH ROLL STANDS
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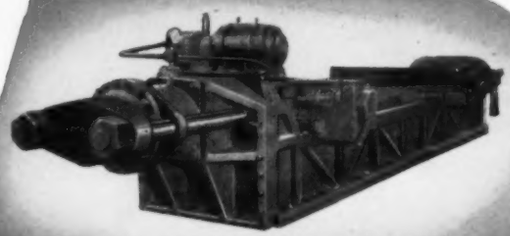
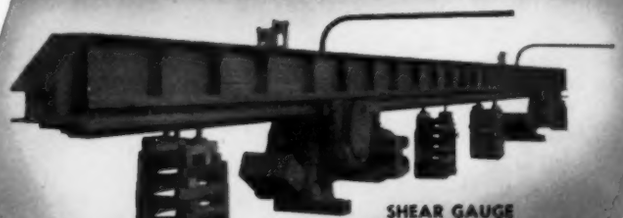
- Continuous PICKLING Lines—ROLLER LEVELERS
- FURNACE Charging Equipment—Furnace Pushers
- Strip Steel COILERS and REELS—SCRAP BALLERS
- RAILROAD Spike Forming Machines—ROLL LATHES
- Sheet GALVANIZING Lines—Wire Patenting Frames
- Stretcher Levelers—Angle and Shape Straighteners
- Rolling Mill Tables—Gear and Individual Motor Types
- PARALLOY ROLLS (Pinch, Coiler, Tension, Steel Mill)
- DUCTILE CASTINGS (80,000 PSI.)



800,000# STRETCHER LEVELER



SHEAR GAUGE STRUCTURAL MILL SHEAR TABLE

PARALLOY ROLLERS

Machinery Built to Customers Design and Detail Drawings

The Youngstown Foundry & Machine Co.

OVER SIXTY YEARS OF SERVICE TO THE STEEL INDUSTRY

Youngstown, Ohio

F&Ym

7★

Lee Wilson

ANNEALING FURNACE DATA SHEET

NUMBER THREE

BASIC ADVANTAGES OF LEE WILSON SINGLE-STACK PORTABLE BASE FURNACES:

1. BETTER QUALITY
2. HIGHER PRODUCTION
3. LOWER FUEL COSTS
4. LOWER FIRST COST
5. LOWER MAINTENANCE
6. LOW HANDLING COSTS

SINGLE STACK PORTABLE BASE FURNACES LOWER FUEL COSTS

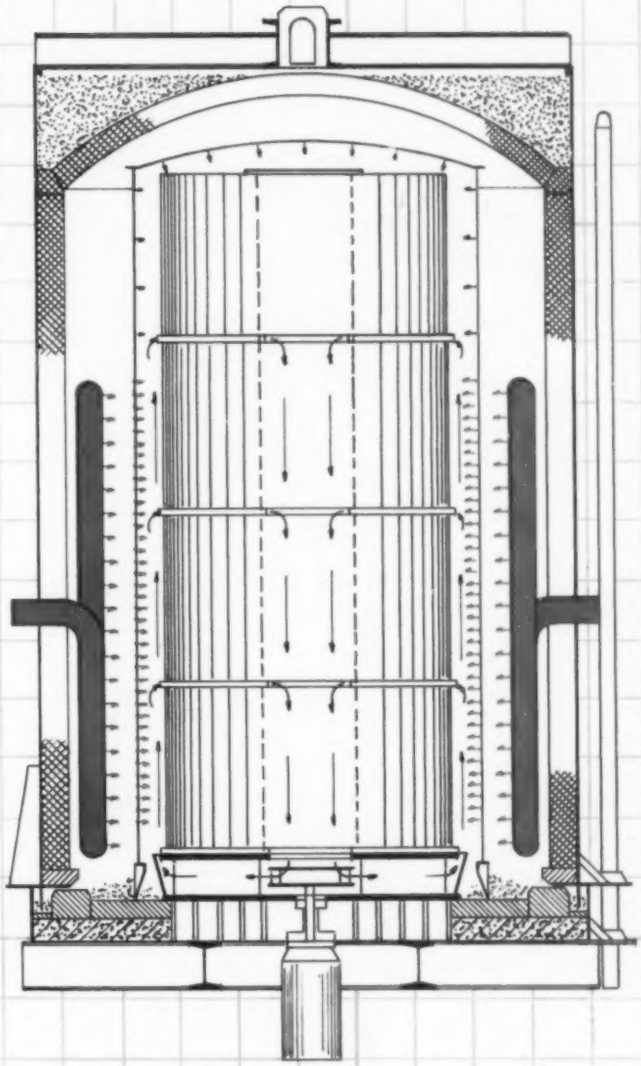
The ability to heat any given stack of steel is almost completely dependent upon the square feet of radiation surface that can be applied **around the bottom of the stack.**

By adopting tubes of the "O" design and placing them at regular intervals around the entire periphery (Fig. 1) of the inner cover the amount of radiation at the bottom of the furnace can be greatly increased and more easily controlled.

By providing twice as many heating tubes, twice as much fuel can be burned, releasing twice as many BTU units, providing much higher heating rates, resulting in faster annealing cycles. In an 8-stack furnace it is still difficult to get more than 2 million BTU's per stack. The Lee Wilson Single-Stack Furnace applies up to 5 million BTU's to each stack.

And since there are a great many more square feet of radiating tube surface in the Lee Wilson Single-Stack furnace, the tubes can be operated at lower uniform temperatures, thereby producing lower flue-gas temperatures, requiring less fuel. Too, the Single-Stack furnace has a lower radiation loss, further decreasing fuel consumption.

The Lee Wilson Portable Base Single-Stack Furnace is today's most efficient annealing equipment — **write for fully illustrated booklet** that completely explains this amazing new system of annealing.



Cross section of portable base, Single-Stack, radiant tube fired annealing furnace which, with high speed convection circulating system, offers the ultimate in bell type annealing for sheet and tin plate coils.

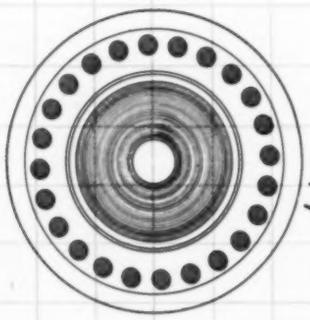
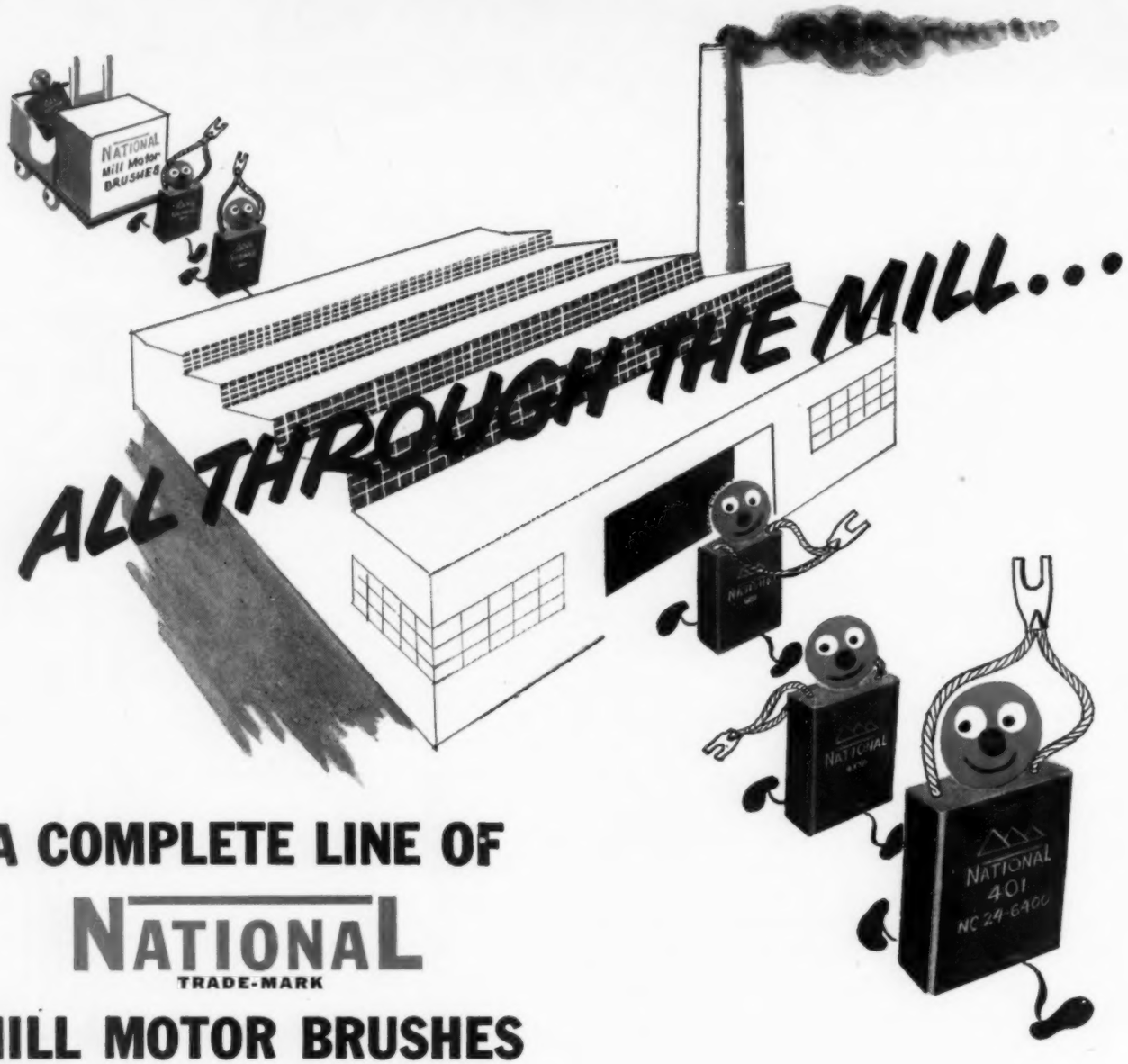


Fig. 1 — In single-stack furnaces it is possible to place tubes at uniform intervals around the entire circumference of the inner cover thereby greatly increasing the amount of radiation at the bottom of the furnace.



A COMPLETE LINE OF NATIONAL TRADE-MARK MILL MOTOR BRUSHES BUILT TO AISE STANDARDS

FRESH attention was focused on industry-wide carbon brush standardization by the recent publication of AISE standard dimensions for all 230V DC Mill-Type Motors.

National Carbon Company has now published a complete list of "National" Mill Motor Brushes, corresponding to *all* the new AISE Standards. GET THIS LIST! From it you can order "National" brushes for *every mill motor in your plant.* Made up in service-proved brush grades that have been "through the mill" for years, they incorporate the latest improvements in tamped-type shunt connections to withstand severe vibration.

Moreover, the more frequently ordered types and grades have been designated "National" STANDARDIZED BRUSHES. They are available from stock at the same low unit price for 100 or 100,000.

The ball is rolling. Let's all PUSH for still further *standardization* of replacement items for *standard* equipment. It means simpler, surer, more efficient operation for YOU!

The term "National" and the Three Pyramids device are registered trade-marks of Union Carbide and Carbon Corporation

NATIONAL CARBON COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.
District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco
In Canada: National Carbon Limited, Montreal, Toronto, Winnipeg

AISE standard numbers for "National" STANDARDIZED Mill Motor Brushes

NC NUMBER	AISE STANDARD NUMBER
20-4800	STD NO. 21
20-5600	STD NO. 25
24-4800	STD NO. 29
24-5600	STD NO. 30
24-6400	STD NO. 32

Write for a complete list of "National" Mill Motor Brushes built to AISE standards

STOP RUST! with RUST-OLEUM

Protects Tanks, Pipes, Girders, Metal Sash, Fences, Roofs and Buildings, Rail and Marine Facilities

BEAUTIFY AS YOU PROTECT—ALL COLORS, ALUMINUM AND WHITE!

RUST-OLEUM may be applied directly over *rusted surfaces without removing all the rust!* Just remove rust scale and loose particles with wire brush and sharp scrapers . . . then apply by brush, dip, or spray. Costly sandblasting and chemical pre-cleaning are not usually required. Easy as that to cut your maintenance costs. Specify **RUST-OLEUM** to your painting contractor or architect for *every rustable* metal surface! Prompt delivery from Industrial Distributor stocks in principal cities.

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FREE SURVEY: A **RUST-OLEUM** specialist will gladly survey your rust problems. He'll make specific tests and recommendations. No cost or obligation. See Sweets for complete catalog and nearest **RUST-OLEUM** distributor, or write for literature on your company letterhead.

Stopping Rust with **RUST-OLEUM** 769 D. P. Red Primer

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- ☐ Full Details on Free Survey
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Look for this label – be sure it's genuine RUST-OLEUM

the BLOOM
TIME-CYCLE REVERSAL UNIT
for Open Hearths and Soaking Pits

THIS factory-wired, compact, cabinet-enclosed unit keeps regenerative furnaces on a uniform reversing cycle without attention from the operator—yet the firing of the furnace can always be altered, or a quick reversal effected ahead of schedule if desired by a simple push-button control. Only nine or ten seconds are required to reverse the average furnace with this unit.

When the firing period for one end is completed, a sequence of operations begins in which fuel and steam are shut off, reversing dampers operate, and fuel and steam are admitted at the other end—all in a predetermined time-sequence that permits full and fast reversal without puffing or smoking. The Bloom Time-Cycle Reversal System is a specially engineered unit that includes provision for operation by checker temperature instead of by time cycle, if desired; automatic "blow" and "hold" furnace operation; protection against excessive checker temperatures; full manual control of the reversal if demanded by the first helper

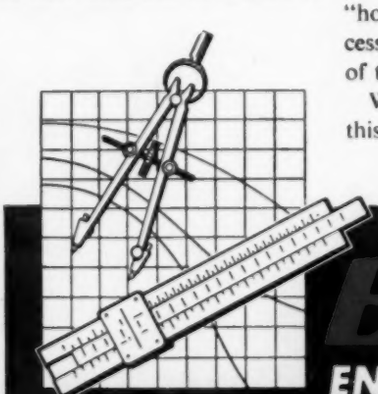
We will be glad to send full information on this unit.

A complete, compact factory-wired and tested cabinet!

The field connections are easily and simply made—no complicated wiring is required. Each unit is completely factory-tested before shipment.

The reversal periods for both ends—North and South—are set independently, and can be changed at any time by a simple turn of the timer.

In case reversal is desired ahead of schedule, the operator merely pushes the reversal button. After reversal, furnace returns to original timing.



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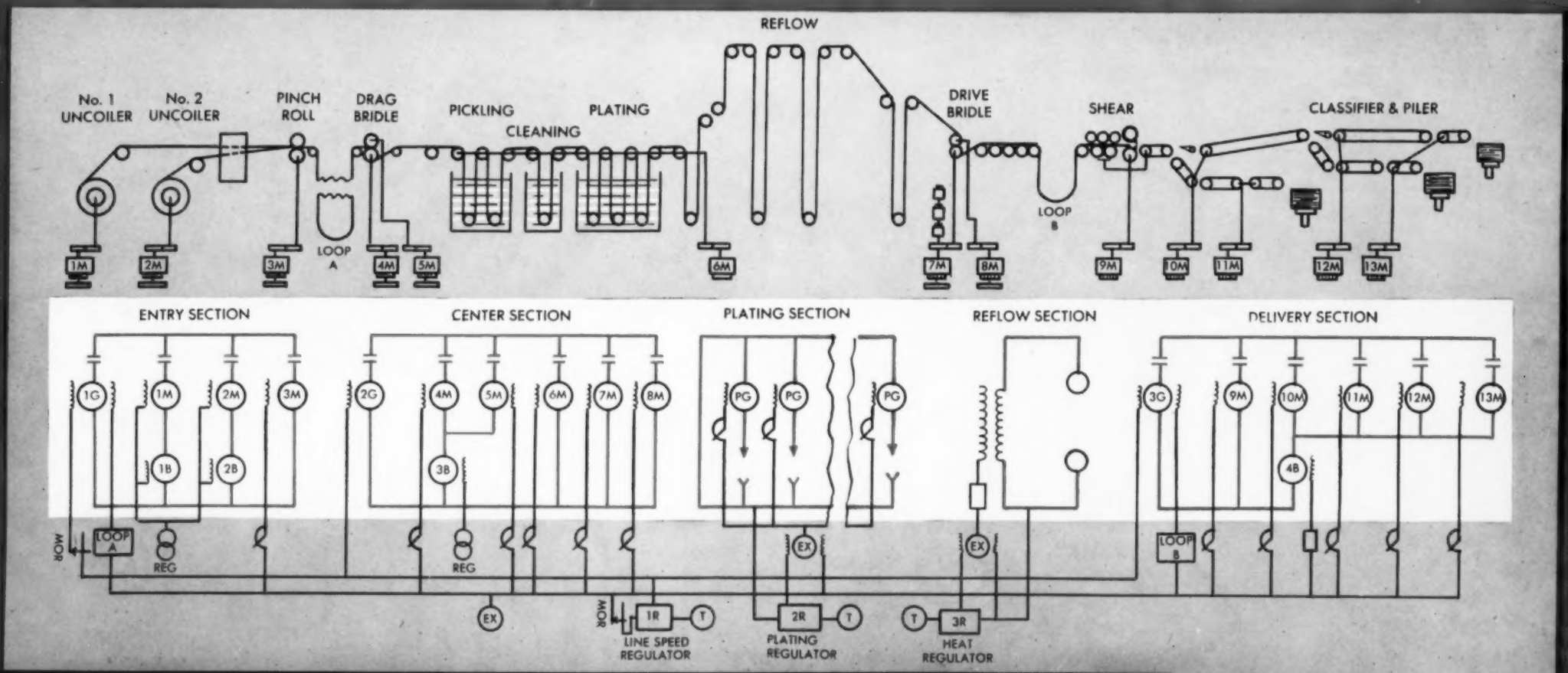

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The drawing above is a simplified graphic representation of an Electrolytic Tinning Line and Control from coil to sheet. Clark provides extremely accurate control for single, dual or triple looping pits at position A. Loop B can be step type or modulated electronic control. Clark specializes in making electronic loop control.

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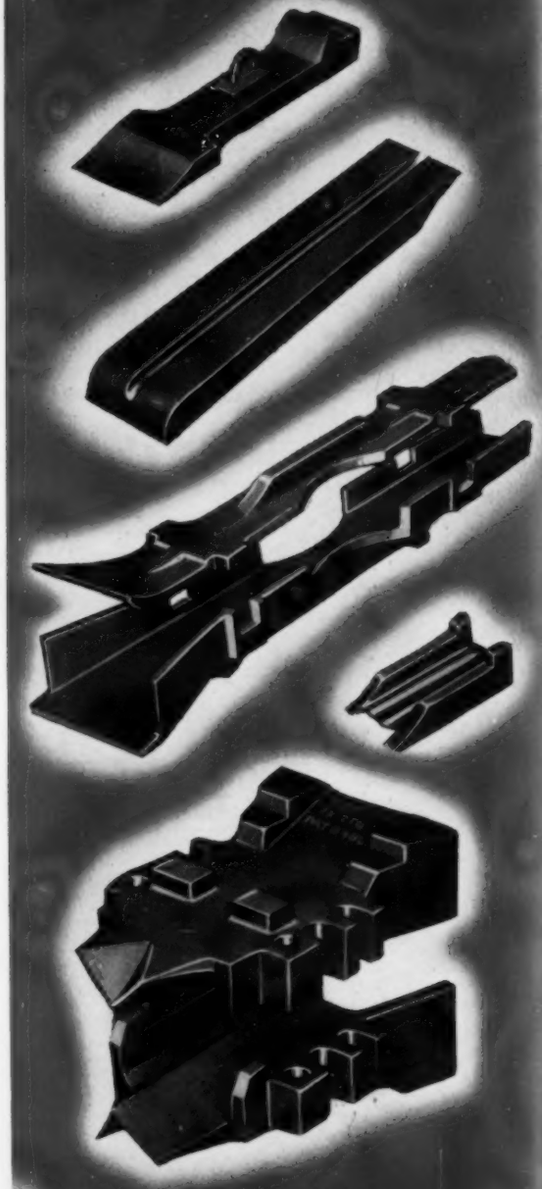

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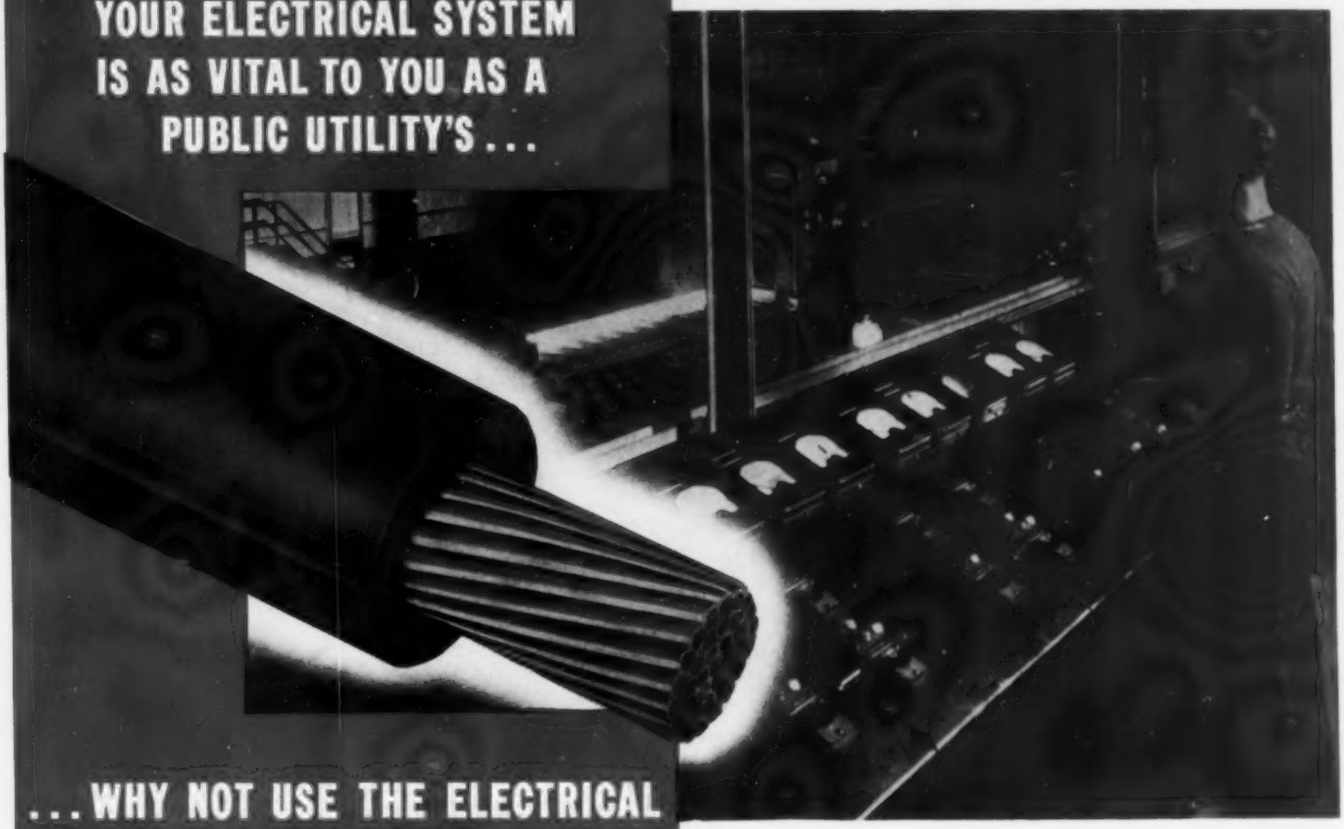

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THE BEST CABLE IS YOUR BEST POLICY

insulated wires and cables

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Cleveland Cranes
FOR
STEEL MILL SERVICE
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Crops *and* Shorts

IF there were ever doubts about the fallacy of substituting government meddling for collective bargaining in industry, they should be completely dispelled by recent shenanigans in the steel dispute. After long-winded "fact-finding" sessions during which both management and union presented their evidence and arguments, the Wage Stabilization Board retired to deliberations involved and mysterious, and came up with some spineless appeasement about as stabilizing as a balky mule in a canoe.

The board's findings, which do not find justification in the public mind, call for 12½ cents per hour increase in wages retroactive to January 1, 1952; 2½ cents per hour beginning July 1, 1952; another 2½ cents per hour January 1, 1953; increases in shift differentials from 4 and 6 cents to 6 and 9 cents per hour; double time for six holidays when worked, single time when not worked; three weeks paid vacations starting after 15 years of employment instead of 25 years; reduction of north-south rate differential from 10 cents to 5 cents per hour; time-and-a-quarter for Sunday work beginning January 1, 1953; adoption of some form of union shop; early consideration of annual wage, severance pay, etc. In all, quite a package, totaling 26 or more cents per hour — a greater jump than the union has been able to win for itself in its years of collective bargaining. Needless to say, the union promptly accepted the recommendations as a basis for settlement, although Philip Murray, doubtless with crossed fingers, grumbled that the union was not satisfied.

The industry members of the panel took the stand that the money settlement went beyond stabilization regulations and would be inflationary; that governmental influence was thrown behind the union shop demand by exploiting the defense emergency; and that the board's recommendations reflected conscious effort to give terms which the union would accept, with no similar effort to assure terms that would be acceptable to the steel companies.

▲

AT one point in the board's deliberations, the public members of the board wanted to recommend a 17.6 cent increase, but industry members would not go beyond 14.1 cents. Public members then bargained with labor members to reach a majority vote on the 26-cent package. Similarly, the public members of the board did not want to recommend a union shop, and voted with industry members against it. The union members, however, refused to accept the majority opinion, deadlock resulted, and chairman Feinsinger collapsed. Reconvening the next day, the public members of the board changed their position and, as the only way to break the deadlock, voted with the union members to recommend the union shop proposal.

▲

CHAIRMAN FEINSINGER recovered to write a 12-page report attempting to justify his board's "fair and equitable" recommendations. In it, he said: "If people were limited in expression of their thoughts to subjects they have studied carefully and objectively, there would be very little written or said on most subjects."

What? No more government publicity?

▲

SUBSEQUENT meetings between representatives of the steel companies and the union have been pointless. The recommended package would increase steelmaking costs about $6 per ton in direct labor and an equal amount in purchased products. Steel companies, though still promoting their original "no-wage-no-price-increase" suggestion, would accept the economic recommendations if price adjustments were permitted — $12 per ton asked, $6 per ton probably acceptable — but this increase seemed not to be forthcoming. Steel companies did offer a 16-cent package, which they feel is the maximum increase permitted by present stabilization regulations, and which was immediately rejected by the union.

During bureaucratic bickering set off by the situation, about the only positive action was the resignation of defense mobilizer Charles E. Wilson, who stated: "I cannot accept public responsibility for stabilization actions which I cannot control."

As furnaces and mills were being shut down for the strike which seemed inevitable, President Truman beat the April 8th deadline by a scant 90 minutes with a speech as biased and unauthenticated as these old ears have ever heard. Documented with misleading and even fallacious "facts" and permeated with political prejudice, it was an announcement that the government was taking over the steel plants to keep them in operation. That puts the steel industry in the same sock with the railroads, which have been under government operation for some 18 months because of a still unsettled labor-management dispute.

As we go to press, we're wondering just how much of the Constitution is left — and who's next.

▲

WE noticed in the paper that a CIO vice president said that Alcoa's "antiquated conception" of setting up wage rates can no longer be tolerated. We'll bet the company is so old-fashioned that it still expects a day's work for a day's pay.

▲

PRODUCTION of iron ore in the United States in 1951 set a record at 116,430,000 gross tons, with an average value at the mine of $5.58 per ton. Of the total production, 80.7 per cent came from the Lake Superior region, 7.2 per cent from the southeastern states, 4.4 per cent from the northeastern states, and 7.2 per cent from western states.

▲

SOME scientist states that a cocktail or highball taken 20 minutes before an A-bomb lands greatly increases chances of survival after irradiation.

And a bomb might fall any minute!

OA

OW

OW/A

OA/FA

OA/FA/FA

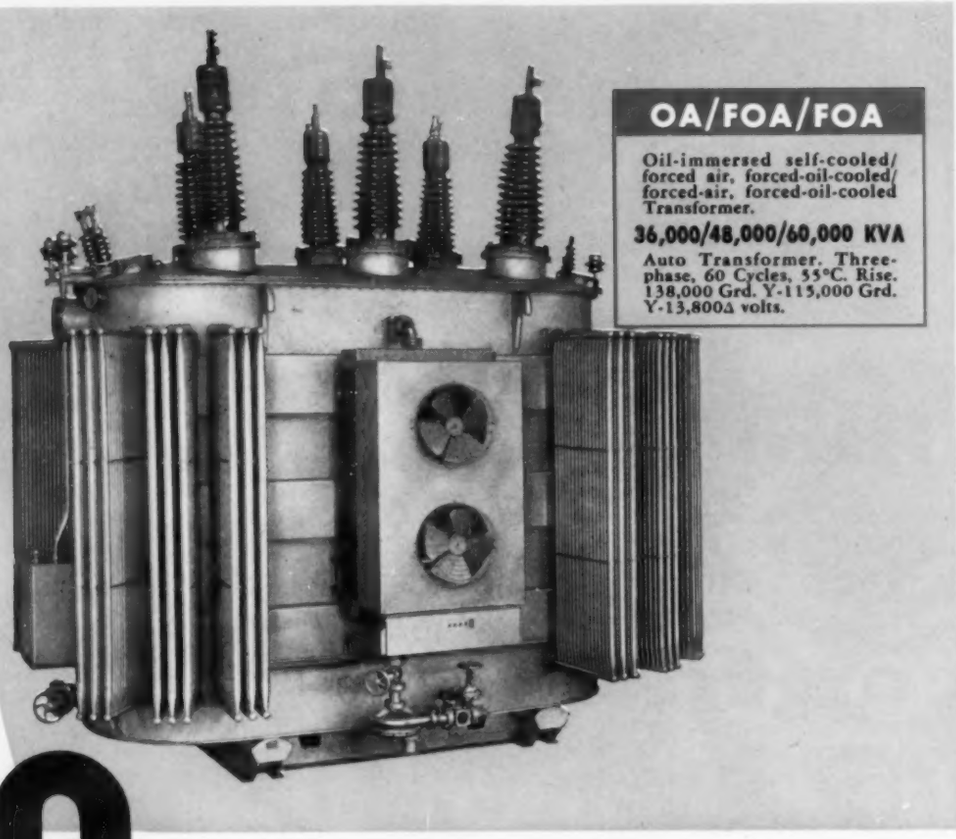
OA/FOA/FOA

OA/FA/FOA

FOW

FOA

9 ways to cool an Oil-



OA/FOA/FOA

Oil-immersed self-cooled/forced air, forced-oil-cooled/forced-air, forced-oil-cooled Transformer.

36,000/48,000/60,000 KVA

Auto Transformer. Three-phase, 60 Cycles, 55°C. Rise. 138,000 Grd. Y-115,000 Grd. Y-13,800Δ volts.

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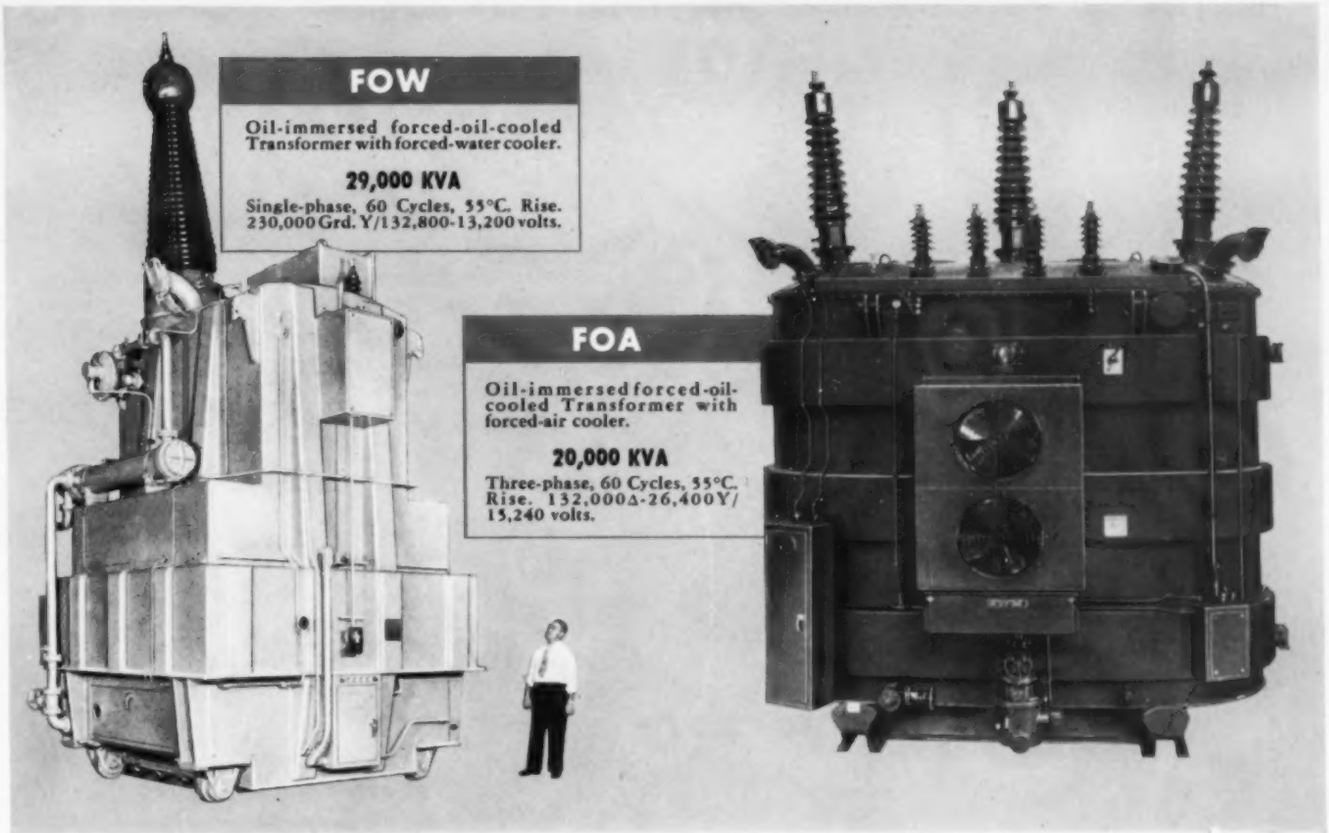
Oil-immersed self-cooled/forced-air-cooled Transformer.

48,000/60,000 KVA

Three-phase, 60 Cycles, 55°C. Rise. 132,000 Y-67,200 Y-13,200Δ volts.


FOW
Oil-immersed forced-oil-cooled Transformer with forced-water cooler.
29,000 KVA
Single-phase, 60 Cycles, 55°C. Rise. 230,000 Grd. Y/132,800-13,200 volts.
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Oil-immersed forced-oil-cooled Transformer with forced-air cooler.
20,000 KVA
Three-phase, 60 Cycles, 55°C. Rise. 132,000Δ-26,400Y/15,240 volts.

filled power transformer

According to NEMA Standards, oil-filled transformers can be cooled in nine different ways. The manner of cooling depends upon many considerations, such as the operating characteristics of transformers using various types of cooling; the availability of large quantities of water; and what is very important, the economics of selecting one type of transformer over another.

The latter consideration may require some study. Auxiliary cooling methods applied to a self-cooled transformer can add, at relatively low cost, as much as 66⅔% additional capacity to the transformer. On the other hand, the efficiency of the transformer and the cost of operating certain types of cooling equipment may be more important considerations than the initial lower cost of a forced-cooled transformer.

These are matters that can best be discussed between the engineers who specify a transformer and the engineers who design the transformer.

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Write for free copy of booklet No. 522 entitled "Economics of Transformer Cooling." This booklet explains the various methods of cooling transformers and discusses their advantages and disadvantages.

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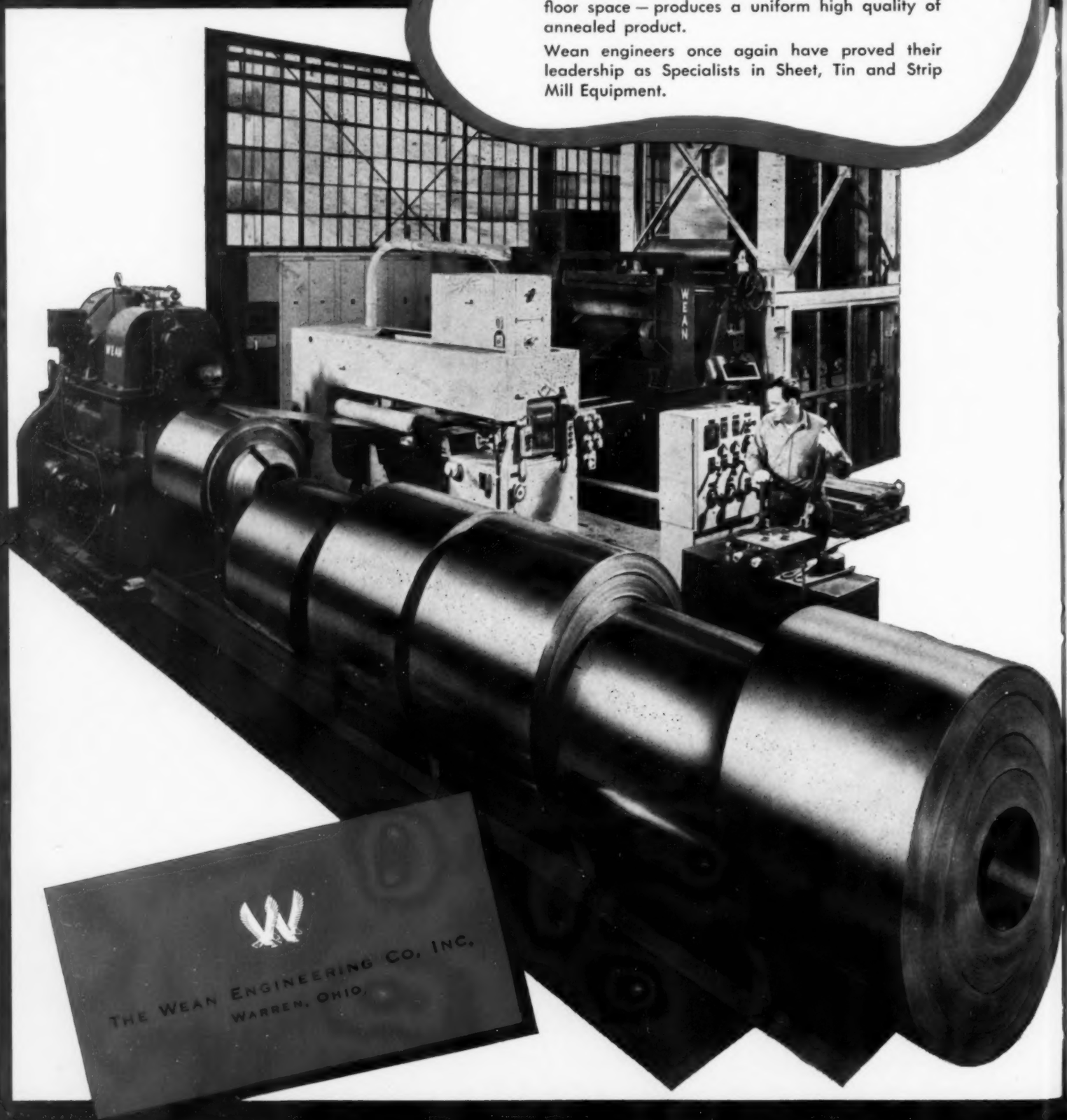

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Iron AND Steel ENGINEER

APRIL, 1952 VOLUME XXIX NUMBER IV

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Published Monthly by
ASSOCIATION OF IRON AND STEEL ENGINEERS
1010 EMPIRE BUILDING
PITTSBURGH 22, PENNSYLVANIA

Statements and opinions given in articles and papers appearing in "Iron and Steel Engineer" are the expressions of contributors, for which the Association of Iron and Steel Engineers assumes no responsibility.

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Indexed by Engineering Index and by Industrial Arts Index.

Single Copy Foreign Prepaid $2.00 Single Copy $1.50
Subscription price in U. S. and Canada (U. S. funds)..... $ 7.50 per year
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MOORE RAPID

WHEN YOU MELT... *Lectromelt*

Roll Turning With Tracer Controlled Lathe

By FRANK F. ZIPF
Superintendent, Roll Department
Bethlehem Steel Co.
Johnstown, Pa.

. . . . tracer controlled lathes can save up to 40 per cent of roll lathe time in machining new rolls and up to 60 per cent in redressing . . . .

▲ TRACER controlled turning machines are not new. They started to become popular in 1930 when electrical controls were applied to engine lathes for the turning and boring of various types of contours. It is also known that the electrical controlled contour lathe was used in England as far back as 1936 for the purpose of turning various types of rolls for steel plants, and although available in this country at that time, it was not used extensively for turning rolls here until early in 1948, due mainly to the lack of promotion on the part of machine tool manufacturers.

Prior to the introduction of the so-called electrical controls, in some roll shops iron and steel rolls were rough contoured on engine lathes by an off-hand method, using tools of high-speed tool steel. The operator would use his cross and longitudinal feed by hand to produce the desired contour, thereby relieving the roll turner of roughing out in the slow, conventional roll-turning lathe.

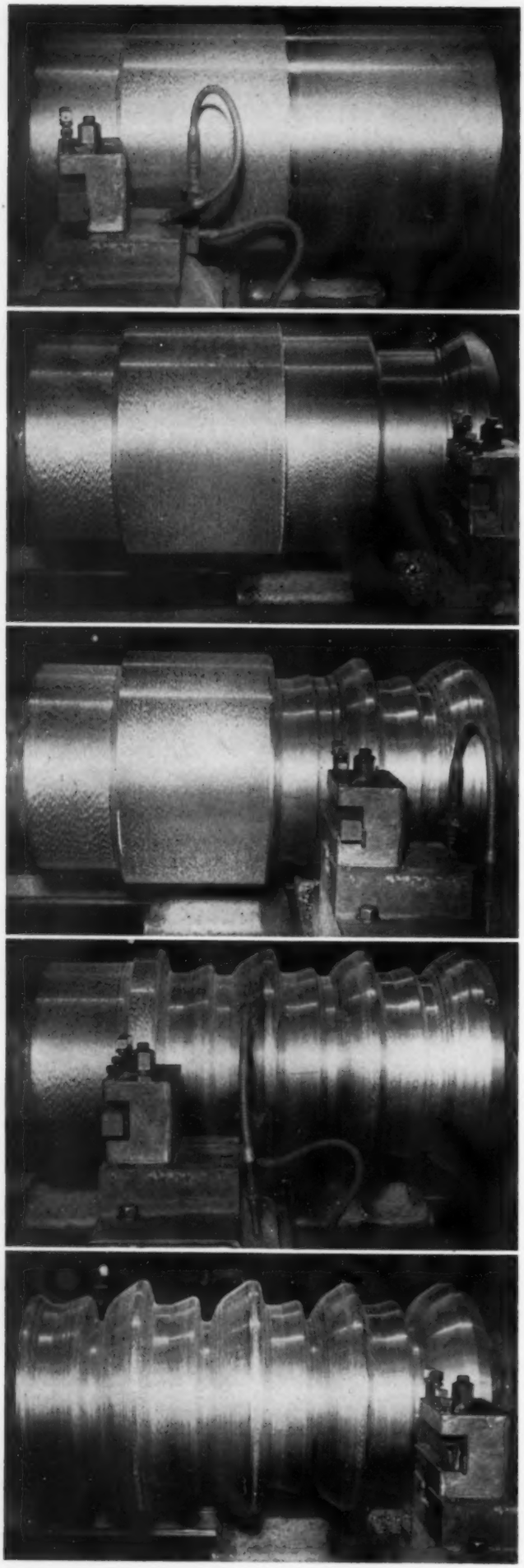
In 1948 one of the steel plants in this country purchased an engine lathe with electrical controls, for the sole purpose of turning rolls, and it has proved its worth as a time saver without any question or doubt. In addition, the average man can be trained to efficiently operate this type machine in four to six weeks, whereas a good roll turner requires a full four-year apprenticeship training. There were several objections, on the part of roll shop operators as a whole, to the use of the contour turning lathes. The greatest objection was based on the mistaken idea that rolls had to be machined on their journals rather than on their centers in order that the body would be concentric. It was also questionable if carbides had been developed to the point, in this country, where they would satisfactorily machine rolls that would run as high as 70 scleroscope hardness.

It must be thoroughly understood that without the various carbides available today these machines would be useless in machining the grades of rolls now used in the steel industry.

In referring to the question of turning on live centers as against turning on journals, it has been established by constant checking through the various re-dressings in the normal life of the ordinary set of rolls, that when journals and centers are true when rolls are newly turned, they normally remain so through the various stages of machining, so long as live centers are used.

Since the introduction of this type of tracer-controlled machine, many manufacturers of machine tools have been developing different types of contour controls. Basically, there are two types of contour controls, electrically operated, and hydraulically operated. They all have their own application and can be found on a variety of machine tools, such as boring mills, planers, milling machines, and various other types of machine tools wherein other than a flat or cylindrical surface is required.

In the electrically operated tracer machines you have two basic types: the electric controls, which utilize magnetic clutches, and all others which utilize controlled motors as a driving medium. In the case of the electric controls in which the tracer follows a shape template, contacts are caused to make and break, and these in turn energize and de-energize magnetic clutches, which operate the cross and longitudinal feeds of a lathe in such a manner that the turning tool follows a path identical with that created by the tracer in follow-



ing the template. The controls utilizing motors also use a shape template as a controlling medium. This template is followed by one of several types of tracers which causes a change in the amount of current which can flow through part of its mechanism. This current is then amplified, and in some cases divided into proportional parts, and is then sent to an electric motor, or a pair of electric motors, which operate the cross and longitudinal feeds of a lathe in accordance to the dictates of the tracer following the template.

In the hydraulically operated tracer machines, we again have two general types: those which operate the feeds through the medium of hydraulic cylinders, and those which operate the feeds through one or more types of fluid motors, which will operate slides through the medium of a screw, or a rack and pinion. In either case a hydraulic valve is used as a tracer, as it follows a template, and depending on tracer deflection, it will cause a hydraulic fluid to go to one cylinder or another, or both, according to the contour required. Or, in the case of the control using fluid motors, the tracer will again direct the flow of hydraulic fluid to one fluid motor or another, depending upon the requirements of the contour being machined.

When tracer lathes were originally put into service in machining rolls, the proper grade of carbide for cutting the various grades of iron and steel rolls became a major problem from a wear standpoint, and because they required considerable of the old "cut-and-try" method before arriving at a grade suitable for both iron and steel rolls. Then came the problem of tool shape, which also consumed considerable time and effort, but has narrowed down to the use of various widths of full round nose brazed-on tips, and mechanically held, right and left-hand facing tools.

The question of grinding carbide tools was very nicely handled due to having a central carbide grinding department which relieves the lathe operator from tool grinding.

During the experiments with carbide tools, the possible saving in time by the use of tracer lathes became very apparent, but the question of suitable finish had yet to be determined. The initial experiments were conducted solely on the basis of rough machining, but as the operators became more proficient in the operation of this machine, it was decided to completely finish the rolls for a four-stand continuous 12-in. rougher on a 10-in. bar mill, in which each stand had duplicate passes, to get an expression from the mill personnel regarding performance. The response from the mill was very satisfying in both respect to finish, which aided pull in the mill, and pass alignment. The fact that both top and bottom rolls for each stand were machined from the same template eliminated the necessity for end adjustment of rolls in the mill in moving from pass to pass across the rolls. End adjustment is usually required on rolls that are manually turned in a roll lathe, as true alignment is impossible where passes break on train line.

Next on the finish machining agenda was a three-

Figure 1 — This is a series of pictures showing the machining of the bottom roll of a 2-high rail mill. It is necessary to change tools to rough in the flanges.

high 10-in. breakdown for an 8-in. mill, and the response from the mill in regard to finish and alignment was just as pronounced as from the other mill.

With the splendid results obtained from the experiments on roughing rolls, it was decided to machine rolls for the finishing stand to determine the quality of finish and accuracy which could be obtained on this machine. Of course, time saving was still one of the most important factors. A section was selected which it was felt would thoroughly test the performance of the tracer lathe versus the roll lathe in regard to turning new rolls and to re-dressing. The time required for machining the new rolls was 40 per cent of roll lathe time, with comparable finish and accuracy, and the time for re-dressing was 60 per cent of roll lathe time, which was conclusive evidence that the greatest saving could be realized by a combination of rough turning in a tracer lathe and finishing in a roll lathe with shape tools. However, there is a firm conviction in the writer's mind that in the near future there will be vast improvements in the tracer lathes and also other methods of machining rolls, which has always been considered a necessary evil by the steel industry as a whole. The only improvement in the craft of roll turning has been in the lathes themselves, from the old open-type headstocks to the present enclosed, worm-drive headstocks, which do not have sufficient speed to efficiently use carbides.

In order to show how the tracer lathe functions on a pair of rolls, a photographic record of the progress made hourly on a pair of rolls for a two-high mill was made on a rail section, which involved tight friction collars and diagonal parting. Figures 1 and 2 show the progress of twenty-six hours of machining time, which on a roll lathe would take one hundred and twenty-five hours, or approximately one-fifth of the time required in a roll lathe. These rolls were 1.56 per cent carbon, 0.77 per cent nickel and 1.13 per cent chromium. The weight of these blanks was 12,300 lb, and the finished weight 8570 lb, a reduction of 3730 lb by machining. Since these rolls were faced and rough-turned in 19 hours, there was an average machining weight of 196 lb per hr, some hours more and some hours less. The stylus used in roughing these rolls was $\frac{1}{16}$ in. larger in diameter than tools used for roughing, to allow material for finishing cut.

There were two tools used on the first roll in facing and three on the second, and the facing feed was $\frac{3}{4}$ in. per minute. The first roll was faced in 56 minutes and the second in 60 minutes, the body of the roll being $40\frac{1}{2}$ in. long, and the surface speed was 130 fpm at 23 rpm. This speed was maintained throughout the roughing and finishing operations.

In roughing out the first roll, five $\frac{3}{4}$-in. full round nose tools were used, with a $\frac{3}{4}$ in. per min longitudinal feed, and $\frac{3}{8}$ in. per min transverse feed, requiring 9 hr. On the second roll, four $\frac{3}{4}$-in. full round nose tools were used, requiring 8 hr. Two $\frac{1}{2}$-in. round nose tools were used for finishing each roll, with a $\frac{3}{8}$ in. per min longitudinal feed, and a $\frac{3}{16}$ in. per min transverse feed, finishing time on each roll being $3\frac{1}{2}$ hr.

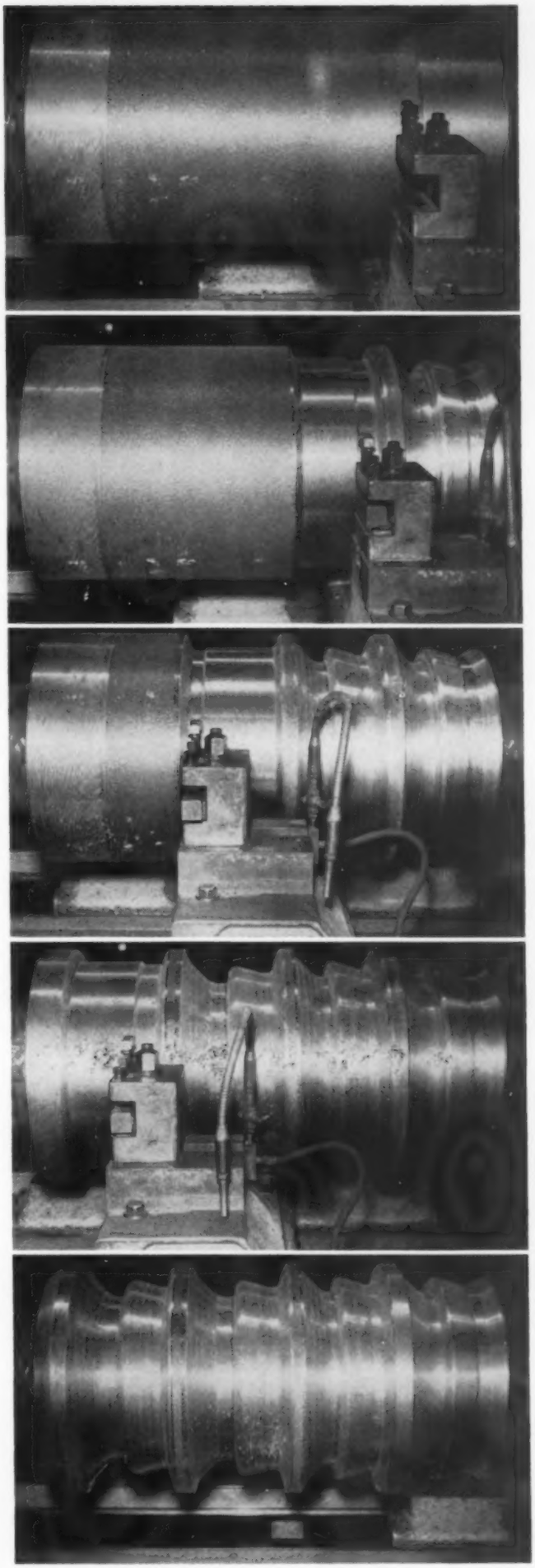


Figure 2 — This series of pictures shows the machining of the top roll of a 2-high rail mill. The photographs also show the air line which is used to maintain the various tools.

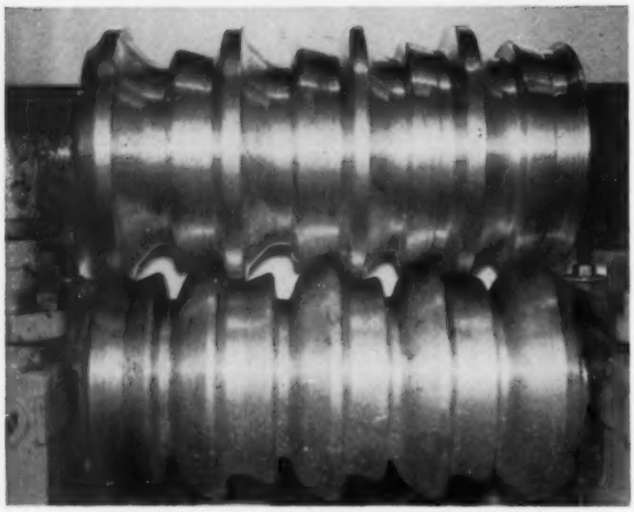


Figure 3 — Completed pair of rolls ready for installation in the mill.

Figure 3 shows the completed rolls topped in roll lathe as they will go into mill.

DISCUSSION

PRESENTED BY

FRANK F. ZIPF, Superintendent, Roll Department, Bethlehem Steel Co., Johnstown, Pa.

WILLIAM MOHLER, Superintendent Roll Department, United States Steel Co., McDonald Plant, Youngstown, Ohio.

ROBERT S. CRAWFORD, Superintendent Rolling Mills, Timken Roller Bearing Co., Canton, Ohio.

MARTIN L. WEIKERT, Assistant Rail and Roll Superintendent, Bethlehem Steel Co., Sparrows Point, Md.

Member: Did you machine that flange on the tracer lathe?

Frank F. Zipf: Everything was done on the tracer lathe. Nothing was done on the roll lathe and at 23 rpm or 130 fpm.

Member: Does the tool get very hot?

Frank F. Zipf: There are times, especially in roughing. We cool by applying air to the tip.

Member: How thick was that flange at the bottom?

Frank F. Zipf: About ½ in. or ⅝ in. thick.

Member: Do you set any limitation on the thickness or the depth of the flange?

Frank F. Zipf: No, we have run them in 3/16 in. thickness.

William Mohler: What Frank Zipf has said about this machine is, as far as I could tell, exactly right.

There is one question I would like to ask and that is what the author uses to braze his tools or his tips on with.

Frank F. Zipf: It is just a standard bronze that is used for brazing, or a standard braze, and a standard tool.

Robert Crawford: Our experience with our lathe has been quite similar to Mr. Zipf's. However, we have had a little more difficulty in producing a finish that we feel is satisfactory for the mill. We are possibly working a little different material than what Mr. Zipf is, and therefore any small markings, that are left in the pass, work through on our finished bar, where they may work out in some other finished bar. We find that our best practice is to finish our roughing rolls and rough out our finishing rolls on this equipment.

I believe, as Mr. Zipf said, that possibly in the future we may be able to finish the job entirely on all jobs. However, at the present I do not think that it is possible to go too far towards the finishing and with this particular machine.

Frank F. Zipf: Mr. Crawford was right in his statement. Our experience has been the same thing; you can finish but that is where you use up your time. We did a pair of finishing rolls. The finish was satisfactory for finishing rolls and the accuracy was just as good as it would be on the conventional roll lathe. However, we have been doing the same as Mr. Crawford. We have been finishing roughing rolls and roughing out the rest of the rolls for the mill.

Martin L. Weikert: We have, at Sparrows Point, a hydraulic controlled duplicating lathe. This machine is located at the rod mill roll shop and serves a 17-stand 3-strand rod mill and a 21-stand, 4-strand rod and bar mill. Our experience is the same as Mr. Zipf's. The greatest saving is in metal removal and the more there is coming off of the roll, the greater will be the saving.

This machine does most of the new and dressed work for the 7 roughing stands of No. 1 rod mill and the 9 roughing stands of No. 2 rod mill. It does nearly all of the necking for both mills, No. 2 mill having tapered necks. It roughs off the bodies of the intermediate and finishing rolls. For instance the body of a 12 × 18-in. finishing roll can be roughed off, taking off about ¼ in. in diam in about fifteen minutes actual cutting time. This would be operating at 14 rpm with 0.090 in. feed per revolution. No groove work is performed on intermediate or finishing rolls as it cannot compete with multiple tool turning in a roll lathe. The time saving factor is job selection.

The 30-hp motor is ample for turning chilled and alloy iron rolls up to 17 in. diam using tungsten carbide tools. If alloy steel were being turned, more power would be needed.

This lathe operates two turns or 80 hours per week performing all of the stated work.

We also have in the pipe mill roll shop a standard engine lathe which was installed in 1937. This lathe is turning new and dressed rolls for two continuous butt weld pipe mills. It also bores the tapered holes in welding rolls and turns the tapered necks on descaling rolls. Tapered necks are accurate and no grinding is necessary. With the use of tungsten carbide tools, this lathe makes a considerable savings over a roll lathe. With a 15-hp motor it is under powered for the full benefits of carbide tools.

QUALITY CONTROL OF LUBRICANTS

By CARLYLE R. BURTON
Superintendent of Maintenance
Hibbing-Chisholm District
Oliver Iron Mining Division
United States Steel Co.
Hibbing, Minn.

. . . . volume purchasing and decreased oil consumption have more than paid for the lubricant quality control program . . .

▲ IT would be well to begin with an explanation of the title of the paper. "Quality control of lubricants" is a term used in the iron ore mining business to determine whether a lubricant is suitable for continued use in a piece of mining equipment.

In order to better understand the need for lubricant control, it is first necessary to describe the equipment used and second, the conditions under which it operates. Many types of equipment are used to mine iron ore such as 1000 to 2000-hp, diesel-electric locomotives, 300 to 400-hp, 30-ton trucks, 15 to 20-ton tractors, 40 to 50-ton diesel and diesel-electric locomotive cranes, road patrols, diesel engine powered shovels up to 5½-yd dipper capacity, electric shovels up to 6½-yd dipper capacity, service trucks, loaders, portable and stationary diesel, gas and electric air compressors and many other types of powered mechanical equipment. In addition to the mobile mining equipment, we have semi-permanent stationary installations for shops, underground mine hoist installations, etc. The majority of the mining equipment operates seven days a week, 24 hours per day. The men are on a 40-hr per week schedule, which means that the equipment is operated by a number of persons during a week. This constant changing of operating personnel necessitates a good control method for lubricant handling and application in order to eliminate the mixing of lubricants and insure the correct application and renewal of lubricants when required. Another obstacle to be overcome in properly lubricating mining equipment is the operating conditions. The majority of mining equipment is started and operates out-of-doors in sun, rain, and snow in temperatures ranging from plus 100 to minus 40 F.

The lubrication control program now in use by the Hibbing-Chisholm district of the Oliver Iron Mining Co. was started by first analyzing the lubrication requirements of all equipment in use and comparing what was required with what was being used. It was first discovered that over sixty-five different oils and greases were used for winter and summer operation. By evaluating and consolidating, this number of lubricants was cut to 12 different products. This consolidation of lubricant brands and types has had a threefold benefit; it minimizes the chance of the mixing of lubricants, it yields a benefit through volume purchasing of lubricants, and it requires less inventory and accounting expense.

The second step in establishing the controlled lubrication program was to make sure that the people responsible for lubrication knew what lubricant was to be used and where. This educational part of the program was attempted in the following manner. On machinery which presented complicated lubricating problems we assigned maintenance engineers to the job of making schematic charts showing each grease or oil check point and indicating the kind of lubrication, amount per application and the frequency of application required.

Figure 1 — Mining equipment is subject to very rugged operating conditions, dust and extremes of temperature.

TABLE I

Type of engine:

Equipment No. 598 — Type of filter: Stanalube HLA (test)

Date July		16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Viscosity		30— B	30— B	30— B	20+ B	30— B	30— B		30— B	30— B	30— B						
Sediment		.09	.15	.14	.14	.18	.30		.30	.27	.10						
Corrosion																	
Hrs on oil	337	345	363	375	387	400	416		424	440							
Hrs on filter	337	345	363	375	387	400	416	X0	8	24							
Hrs on grease and filter	31	X8	26	38	X12	25	41		X8	24							
Hrs on nugent	31	X8	26	38	X12	25	41		X8	24							
Total hrs on engine to date	385	393	411	423	435	448	464		472	488							
Oil added 1 day (OT)		4			6	4	4	7	10	23	7	14					
Type of oil		26	104	86	83	82	105	60	50	91							
Type of fuel																	
Remarks:																	
Hrs. on transmission	385	393	411	423	435	448	464		472	488							
Hrs on differential	385	393	411	423	435	448	464		472	488							
Hrs on torque converter																	
Screen																	

Equipment No.

These charts were posted on the equipment together with a list of the lubricants to be used on the particular equipment. This list is used in ordering lubricants from our central storage point.

A sound slide film was made showing the correct method and the importance of lubricating a particular type of equipment. The aid of the operating foremen in the various mines was enlisted by having meetings at which the cost of improper lubrication was emphasized by citing costs of repair which could have been eliminated on the equipment in their charge by proper lubrication and by showing them the film slide on how and where the lubrication should be done. The workmen directly responsible for the lubrication of machines were then called in and instructed with the film slide, pointing out the costs of faulty lubrication and what was being done to make their job easier. The lubricator's job is being made easier by the installation of the lubrication charts, power greasing equipment, both air and electric barrel pumps with retractable grease hose reels, centralized lubricating systems and better lubricant handling facilities. In some instances, for mobile equipment operating "around the clock," we have provided a lubrication truck, carrying the necessary lubricants, to go to the equipment on the job and aid in the lubrication.

The third phase of the controlled lubrication program involved insuring that the best lubrication was being

Figure 2 — Oil samples are taken daily from all equipment which is in continuous operation. These samples are sent to the analysis laboratory.

Figure 3 — A simple viscosity check is made on the oil sample which is sent to the laboratory. This is done by comparing the rate of descent of a steel ball in the oil being checked against standard oil.

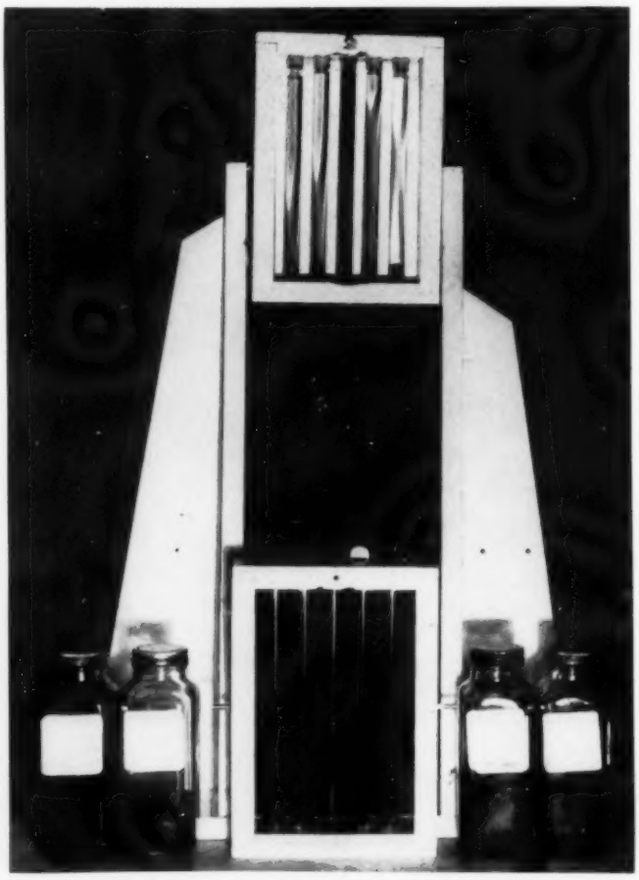


Figure 4 — Another laboratory test made is to run the oil sample through a centrifuge for twelve minutes.

obtained for the least amount of expense. First, one of the large expense items in our lubricant cost, engine crankcase oil, was checked to determine whether the recommended change period was correct. In order to decide whether the change period for crankcase oil was correct, a program was set up to take a sample daily from a representative group of each type of equipment. This sample was then analyzed to determine whether it would meet the minimum specification required for proper lubrication of that particular type of equipment. It was soon discovered that no blanket oil change period could be set up which would cover all engines in any particular type of equipment. The change period recommended by the engine manufacturer is the period that is best for the average engine. It does not mean that if the recommended change period is followed on all of their engines, no operating difficulties will be experienced due to faulty lubrication. Some engines may dilute the oil to a dangerous extent, due to faulty injection or poor carburetion, in a relatively short number of hours, while others may develop water leaks into the lubricating system or contaminate the crankcase oil due to engine blowby or faulty operating temperature. Still other engines may continue to operate for hour after hour and the oil will remain in a "good as new" condition. It seemed reasonable to expect that if a simple check could be made daily of the crankcase oil condition in all engines it would be possible to decrease the oil change frequency and to minimize the danger of losing an

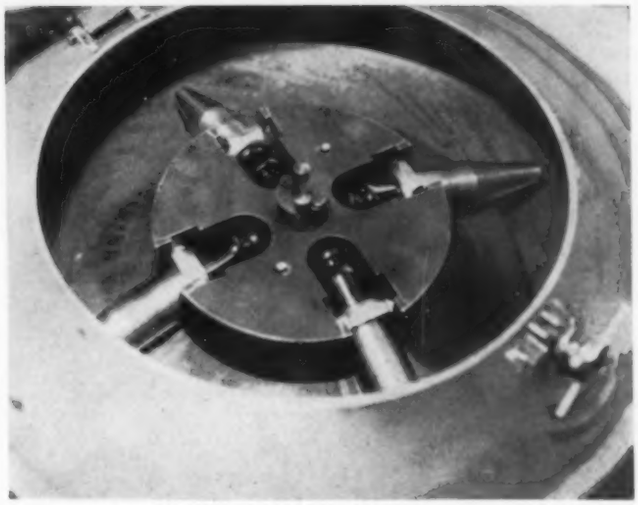


Figure 5 — Oil samples are shown in the centrifuge.

engine due to faulty crankcase oil, as well as to extend engine life by reducing wear.

Utilizing the experience of lubrication experts from various oil companies, the following procedure was developed. Oil samples are withdrawn daily from all equipment that has been operating continuously and the samples are sent in to an oil analysis laboratory. The sample of oil is taken by using a special suction gun which was developed for the purpose. Some installations are provided with a pet-cock drain where a representative sample may be taken. However, we prefer the sample gun method because it eliminates the danger of oil loss due to vibration breaking of auxiliaries to the pet-cock drain or loosening of the pet-cock valve. It also avoids contamination of the sample.

Two simple checks are then made on the used crankcase oil; the first is a viscosity determination in which a small sample of the used oil is placed in a test tube with a steel ball. This tube is then placed in a rack along with other tubes containing samples of the same new oil of different viscosities. For example, if the used oil being checked was originally an SAE 30 oil, the samples of new oil would be SAE 30, 20, and 10. The falling sphere comparative rack is then tipped over and the dropping speed of the steel ball is noted in comparison with that of the steel balls in the samples of new oil of the different viscosities. The used oil is then rated as a plus or minus 30, 20 or 10, depending on the relation of its viscosity to the viscosities of the samples of new oil.

The sample is then diluted 50 per cent with benzine in a special calibrated tube and is centrifuged for 12 minutes. After spinning, the percentage of solids, now accumulated in the end of the tube, is noted and recorded. The results of these two simple tests are then recorded on one sheet for comparison. The figures obtained from these two tests for the various samples of used oils are then compared with standard allowable limits of viscosity and sediment which have been established from our past experience. The viscosity limit is 10 points lower than the unused oil. For example, if the comparative viscometer indicated that the viscosity of a used oil sample was approximately the same as that of a new SAE 20 oil and the original oil had been an SAE 30, the unit would be allowed to operate. However, if the viscosity of the sample tested lower than the

TABLE II

OLIVER IRON MINING CO DAILY SERVICE REPORT

Date: 7-26-51 Location: Pillsbury mine

Truck No.	Time	Grease service and nugent bag change	Time	Oil filter change	Crankcase breather filter service	Time	Lube oil change	Time	Air filter change
599		X			X				X
600		X			X				X
486		X							
524				X			X		
401		X			X				X
359				X					

limit, steps would be taken to bring the unit in immediately for an oil change and a check-up. The limits on sediment have been set at 0.6 per cent by volume for a truck, tractor, grader, or car engine, and 0.14 per cent sediment by volume for a diesel locomotive or similar unit crankcase oil. If the sediment in the used oil sample is found to be above the limits we have set up, the oil laboratory calls for a cartridge change in the lubricating by-pass filter. Attempts are being made to standardize on a re-packable lubricating oil by-pass filter cartridge in order to lower the cost of a filter cartridge change.

From the posting sheet, on which all the samples for that day are posted, the laboratory technician posts to an individual unit engine card the results of the sample examinations and the number of operating hours. A call sheet is then made out for each mine, garage or foreman, depending on the condition, using the complete sample posting sheet and the individual engine card sheet as a guide which lists any periodic check to be performed and the necessary measures taken to correct the faulty oil condition. Some of the items found on this sheet, that have been previously set up by the foreman in charge of the equipment, are: grease job (based on operating hours), oil change, oil filter cartridge change, injection system check, check for fuel, water or hydraulic oil or lubricating oil leaks, special filter checks or changes, or any other item the foreman in charge of the equipment may have set up on an hourly basis. The information from this sheet is then forwarded to the foreman, garage or shop, depending on how the work is to be handled; the work required is completed and the noted sheet is returned to the oil laboratory. Every two weeks the oil laboratory prepares a report that is sent to the lubrication foreman, truck and tractor foremen, locomotive foreman, and superintendent of maintenance. This report contains a two-week summary of the crankcase oil condition of equipment under the supervision of the oil laboratory. The report includes such items as total engine operating hours during the period the report covers, crankcase oil added, number of oil changes, number of filter changes, hours on the oil since last changed and hours on the filter since last changed. The report also tabulates the engine crankcase oil consumption in quarts per hour of each engine for a four-month period. This same report tabulates the units that had crankcase oil dilution or high sediment and fuel oil consumption. The report gives the maintenance foreman a very good picture of the engines under his care and allows him to plan for engine change-outs and overhaul in advance. When engines consume one quart or more per hour of crankcase oil, they are changed out or overhauled. See Table I.

At the present time there are 260 pieces of equipment for which the oil laboratory handles the quality control of the lubricants. The oil laboratory also analyzes incoming shipments of fuel oil, recommends cooling water

Figure 6 — After going through the centrifuge, the amount of sediment in the oil sample is checked to see if it exceeds allowable limits.

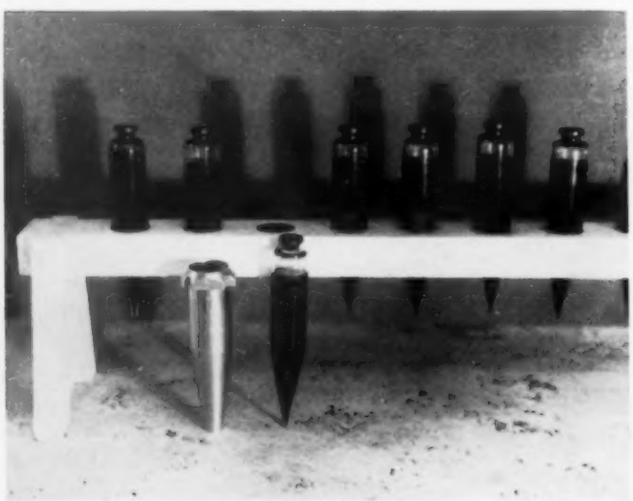
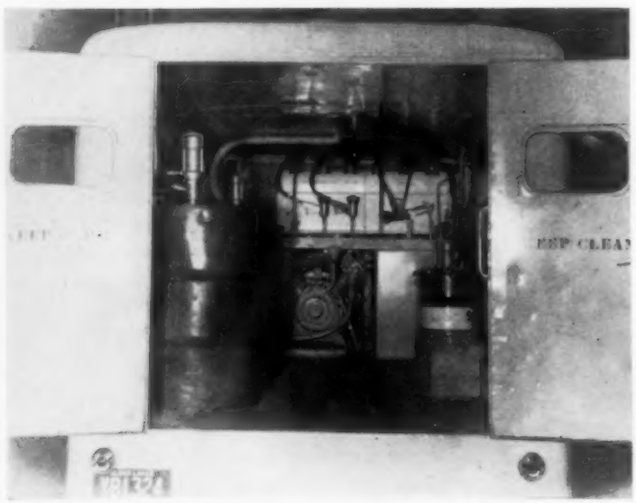


Figure 7 — Lubrication service truck is also used to move to certain pieces of equipment.



treatment, and analyzes greases and oils to determine that they meet the specifications required. The cooling water is sampled periodically, tested, and reported in the same manner that the lubricating oil is handled.

The quality control of lubrication is one item in a preventive maintenance program which is in effect in the Oliver Iron Mining Co. This program is aimed at increased production with less downtime of equipment and at keeping repair and maintenance costs at a minimum. The quality control of lubricants has had good acceptance by the maintenance foremen because it eliminates clerical work that would have to be done by him or his mechanics, besides giving him a check on engine conditions. The maintenance foremen are now changing-out or overhauling engines based on an oil laboratory report on oil consumption. This means a planned delay instead of a breakdown to the mine operators. You may wonder how the expense of such a program is justified. It may be stated that the saving afforded the company due to volume purchasing and decreased oil consumption has more than paid for the expense involved in the described program. Decreased engine wear, which means lower repair and maintenance costs and increased mine production, is an additional benefit derived from the program.

With the aid of lubrication experts, further experimentation is being made towards the consolidation of oils, greases and various checks to arrive at even more effective quality control of lubricants.

DISCUSSION

PRESENTED BY

DONALD E. WHITEHEAD, General Lubrication Engineer, Crucible Steel Co. of America, Pittsburgh, Pa.

CARLYLE R. BURTON, Superintendent of Maintenance, Hibbing-Chisholm District, Oliver Iron Mining Division, United States Steel Co., Hibbing, Minn.

WILLIAM M. SCHUCK, Lubrication Engineer, Armco Steel Corp., Middletown, Ohio

MAURICE RESWICK, Engineer, Standard Oil Development Co., Linden, N. J.

ANDREW CICHELLI, Lubrication Engineer, Bethlehem Steel Co., Bethlehem, Pa.

CY ROBB, Maintenance Engineer, United States Steel Co., South Works, Chicago, Ill.

Donald E. Whitehead: I would like to hear about the hardships involved in the handling of lubricants in temperatures of forty degrees below zero, whether it is necessary to predilute those crankcase oils, and what greases could be used, in regard to the N.L.G.I. consistencies selected.

Carlyle R. Burton: In answering Mr. Whitehead's question with regard to how we handle lubricants in forty below zero weather, I first wish to say it is quite a problem. We use a winter and summer grade of lubricant. Equipment that is operated intermittently is changed over in the fall from summer to winter grade of lubricant and back again in the spring. Other equipment that operates continuously or around the clock, such as the large ore hauling trucks and locomotives are kept on summer grade lubricants. Some of our greases used in the winter are an extremely fluid material, but we increase our frequency of lubrication in an attempt to compensate for the loss in lubricant viscosity. In the past it has been the practice to dilute crankcase and gear housing lubricants. The crankcase lubricants were diluted with gasoline or kerosene and the gear case lubricants thinned with kerosene or penetrating oil. The oil companies have now developed low temperature lubricants that enable us to start equipment without diluting the lubricants. However, we do use starting fluids injected into the air intake manifolds of diesel engines on some units.

William M. Schuck: It is evident that the quality control program as he has outlined it to us is a practical, workable, preventative maintenance tool that results in lowered costs and decreased operational delays. There are however, several points in Mr. Burton's paper that the speaker feels might be elaborated upon.

It was stated that daily test samples of crankcase oil are taken and tested for each unit operating on a continuous basis. This daily schedule was adopted at the advice of various oil company personnel. The speaker feels that a twenty-four hour sampling basis is an extremely short check period. Can you state whether this test period has been justified by practice and field experience?

The second periodic test described by Mr. Burton was a centrifuge check to determine the crankcase oil sediment volume. In this test, engines of the truck, tractor, grader and car engine classifications have been allowed a sediment limit of 0.6 per cent by volume while the diesel engine category has been limited to only 0.14 per cent allowable sediment. I am sure we would be interested in the reasons and practices whereby these limiting values were determined.

Carlyle R. Burton: In attempting to answer Mr. Schuck's question as to why a twenty-four hour sample period was chosen, a little past history may be pertinent. When our sampling program was originally started we intended to merely continue sampling long enough to determine if our oil changing practice was correct. We soon discovered that the oil change period we were then using resulted in excessive wear and the loss of occasional engines due to dilution or excessive dirt in the lubricant. By streamlining our sampling program, we found it sound practice to continue with our twenty-four hour sampling period in order to minimize our chances of losing an engine due to excessive wear. The number of cases of dilution, caused by fuel or water, and dirty lubricants caused by engine blow-by or excessively dusty conditions, within the period of our past lubricant change period governed our decision to continue the twenty-four hour sampling period. We have lengthened our sampling period to a week for some equipment that is operated only eight hours per day.

In answer to the second question as to why the 0.14 per cent by volume sediment limit for diesel locomotives and 0.6 per cent by volume sediment limit for all other equipment was chosen, it may be stated that these figures were picked based on past experience. Recommendations were solicited from equipment and engine builders, oil companies and other users of similar equip-

ment. This information combined with our actual experience with the per cent by volume sediment in the lubricant at the end of the recommended hours of use aided us in the selection of the per cent sediment limits of 0.14 and 0.6 per cent. The size of the unit, cost of overhaul, and the crankcase and filter capacity have indicated that we keep the sediment lower in our diesel locomotives than in trucks, tractors and similar units.

Maurice Reswick: I presume that one reason why Mr. Burton has chosen the twenty-four hour period for inspection of the oil is because the atmospheric conditions are such that the machinery becomes filled with dust. I am wondering if any special attention is necessary in the maintenance of the filters, such as more frequent reconditioning, or perhaps using a filter of larger sizes.

Carlyle R. Burton: Mr. Reswick's inference is correct for these units do operate at times under very dusty conditions. We have made special attempts to prevent the dust from getting into the crankcase oil. We do use an oil bath air cleaner, and we have cut the recommended filter change period down to an eight to ten hour period in some cases, the average length of service on the truck and locomotive is about forty hours. In the winter we lengthen the period to one-hundred hours for the air filter cleaning program.

Andrew Cichelli: How many men do you have in your laboratory?

Carlyle R. Burton: Our laboratory group includes the following: a chemist, three technicians, and part of the time of a lubrication foreman. The technicians may collect samples, analyze the samples or keep the records. A total of five men constitute the laboratory force.

Cy Robb: I would like to know if the precipitation is measured, if you do analyses on the precipitation or do you accept the oil that you are now using? Is there any deterioration, or is there a constant precipitation? Do you analyze it to see if you are tearing your engines apart?

Carlyle R. Burton: We are not equipped in our small laboratory to analyze the sediment, but we have sent samples to some of the leading oil manufacturers who have sent us reports showing the percentage of the additive left in the oil. The composition of the sediment is iron, quartz and silica from the air and a percentage of lead, etc. We feel that by keeping down the percentage by volume of the dirt in the oil that we are partially minimizing ring or bearing wear, or, as you say, tearing the engine apart.

COAL GASIFICATION SHOWS PROMISE

▲ TWO international scientific conferences just held in this country promise to benefit not only the European nations represented, but also the people of the United States. The two sessions formed the high point thus far of cooperation between scientists and technologists of the Bureau of Mines and those of several European countries in studying the direct gasification of coal, both above ground and in the seam in which it occurs. They resulted in the following conclusions:

1. The growing demand for gas, gasoline, and chemicals has called widespread attention to the approaching need for using coal as a raw material for these products. Direct gasification, as opposed to processes in which coal is coked before gasification, is one of the most important steps in obtaining such products from coal.
2. Huge resources of low-rank coals and lignites, which cannot now be exploited economically by standard techniques, are available for direct gasification.
3. High efficiency, through large capacity equipment for the gasification of coal won by standard mining methods is being developed in the United States and in Europe. It has been demonstrated that operating under atmospheric pressure and at 30 atmospheres is entirely feasible.
4. Experiments on underground gasification of coal in the bed have been carried out in Belgium, French Morocco, Italy, the United Kingdom and the United States, using air. Large-scale model experiments using oxygen and steam have been carried out in Belgium. These experiments have yielded both practical and fundamental scientific knowledge.
5. A program of further systematic experimentation in Belgium, French Morocco, the United Kingdom and the United States has been developed. This program, offering considerable promise, includes experiments with (a) the percolation system using electrical, hydraulic, and pneumatic methods for connecting the vertical boreholes, thus avoiding the construction of underground tunnels; (b) the classical stream method in which preheated air is blown at high velocity through a prepared passage; and (c) a process using parallel passages opened along the pitch of the bed and unidirectional flow of oxygen and steam.
6. The several systems mentioned are adaptable to wide range of geological conditions and purposes. Their common aim is to produce gas at low-cost with either air or oxygen, depending upon the type of gas required. The combined results from all the countries indicated that this is feasible.
7. Successful development of these processes may eventually reduce underground work, increase productivity, and open to economic access sources of energy previously unexploitable. This will open new employment opportunities. Both the underground and above ground processes will make the world's large coal reserves a basic commodity for meeting ever-increasing demands for liquid and gaseous fuels.
8. The social and economic importance of this research can hardly be over-estimated. For instance, Europe's coal budget is around $6 billion a year, including imports. When eventually developed for commercial application, underground gasification may save a considerable part of this budget as well as giving the flexibility necessary for adapting production to fluctuating needs.

Latest Developments

IN EXTRUSION OF METALS

By ERWIN LOEWY
President
Loewy Rolling Mill Division
and
Hydropress, Inc.
New York, N. Y.

. . . . the development of new lubricants and larger equipment is opening up an entirely new field for the extrusion process . . . .

▲ THE first half of the twentieth century has seen the growth of the extrusion process to the foremost ranks of methods for converting metals into wrought shapes. Confined almost exclusively to the working of lead during its early stages of development, the application of the extrusion process spread to the copper and light metals industry. Finished and semi-finished products in a wrought condition were produced in a rapid and economical manner with good mechanical and metallurgical properties. Products thus produced were of high dimensional accuracy, where finishing and machining operations were reduced to a minimum and, in many cases, entirely eliminated. Industry was quick in recognizing the merits of this process and attention was directed towards the development of techniques for extruding high alloy steels, stainless steels, nickel alloys, in short, so-called high temperature alloys.

The extrusion of these metals and alloys presented new problems. So that we may understand the problems involved let us at this point briefly review the extrusion process and its terminology. In principle, it is similar to squeezing a ribbon of toothpaste from a tube. The first, and foremost, type of extrusion is a hot working operation, the metal being pre-heated to give it a suitable degree of plasticity. This type of extrusion is referred to as hot extrusion. In the customary methods, solid cast or pre-forged billets of cylindrical shape, placed within a strong-walled enclosure—the container—are caused to extrude through a die under the powerful pressure exerted by a hydraulically actuated ram. The orifice of the die is so shaped as to impart the required form to the product. A simple diagram of the arrangement is shown in Figure 1. For the extrusion of tubing from solid billets, the billet is brought into the container (A), pierced by a piercing mandrel (B), and the hollow billet is then forced through the die (F) by the action of the pressing stem (C) with the piercing mandrel, which now acts as an ordinary guiding mandrel, advancing simultaneously with the stem. A dummy block (D) is placed between the billet and the stem.

Figure 2 shows a cross-section of a tube and rod extrusion press.

Extrusion can also be carried out with the metal in the cold state, this being dependent upon compositions of the alloys, pressure requirements and other conditions.

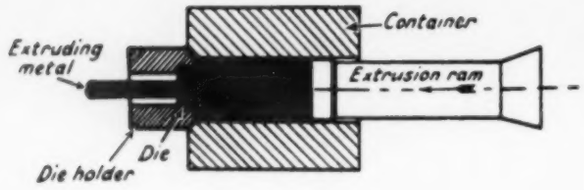
This paper will deal with developments in the first type of extrusion, namely, hot extrusion.

The magnitude of the problems presented in the extrusion of steels and other high temperature metals and alloys can best be indicated by the following:

1. The billets have to be extruded at temperatures ranging from 1800 to 2300 F in order to have the degree of plasticity necessary for the metal to be forced to flow through the die orifice.
2. High unit pressures are required to extrude these metals.
   The tools may have to withstand repeated thermal shock. During extrusion, the tools reach temperatures of 1100 F, then cool to about 700 F after extrusion. This is repeated during each cycle.
4. The dies, dummy blocks, and piercer points have to resist upsetting, and at the same time, resist bursting or tensile stresses.
5. The alloys from which the extrusion tools are made require high wear, and heat-resisting qualities.
6. The rams and mandrels have to be made of materials that resist deflection, and yet in the case of mandrels, have to resist the tensile stresses induced by the metal being extruded.
7. Finally, methods of lubrication have to be applied which give good tool life.

The early developments of the extrusion techniques for high temperature metals and alloys, commencing in 1926 with the extrusion at about 1900 F of cupronickel, is well covered in a paper presented by Hugo Lorant.[1]

* Numerals refer to Bibliography at end of article.



SOLID EXTRUSION

TUBE EXTRUSION

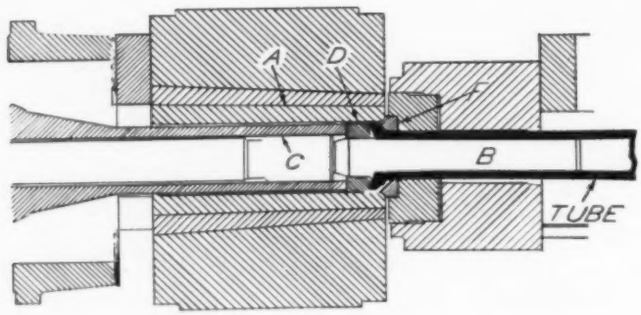


Figure 1 — The technique of modern tube extrusion is indicated in this drawing.

In 1943, fifteen years after the first commercial extrusion of nickel and high-nickel alloys at the Zenith works of Henry Wiggin and Co., Ltd., Glasgow, Scotland, a 4000-ton horizontal extrusion press with an independent piercing arrangement was installed at the Huntington works of International Nickel Co. in West Virginia. This press was used to extrude solid billets of monel, inconel, and nickel ranging in diameter from 7 to 12 in. into tubes of 3 to 8-in. outside diameter by ¼-in. to ⅝-in. wall thickness. In addition, stainless steels and special heat resistant alloys containing cobalt were extruded in this press on an experimental and, in some cases, on a production basis. Some of these materials were difficult to transform into the required shapes by any other known method (2).

The 4000-ton extrusion press designed and built for International Nickel Co. has a unique patented feature for extruding tubing from solid billets which enables the die opening to be sealed off prior to extrusion by means of a solid plate. As the mandrel advances, the metal displaced by the mandrel is forced to flow back and fill the container whereas in previous practice this metal was forced out of the die and was scrapped. By this so-called cupping method only a thin disc of metal, left between the tip of the mandrel and the solid plate, is scrap. Thus, approximately 20–30 per cent of the billet weight that would otherwise have been lost in scrap, is converted into usable tube weight, resulting in the production of longer tubes. Figure 3 presents a diagrammatic view of the extrusion process using the cupping method. Notice the thin disc in front of the die opening in (b) and (c). Between steps (c) and (d), that is when the billet has been completely pierced, this disc is removed and the extrusion is carried through to completion.

It has been reported that in the extrusion of nickel or monel tubes of the more common sizes, both the mandrels and dies withstood about 175 extrusions; in the case of inconel, about 75 extrusions were obtained. The conditions which gave this performance were as follows: (2)

1. The billets were heated in a natural gas-fired rotary hearth furnace under a reducing atmosphere.
2. The mandrels, dummy blocks, and piercer points were made of a tool steel having a composition of 9.0 per cent W, 3.25 per cent Cr, and 0.28 per cent C. They were tempered and double drawn to a hardness of Rockwell "C" 46–48.
3. The dies were made of an alloy steel with an analysis of 4.75 per cent Cr, 1.2 per cent W, 1.5 per cent Mo, and 0.35 per cent C, heat treated to a hardness of Rockwell "C" 46.
4. The tools and liner of the container were heavily lubricated with a mixture of graphite and oil just before the extrusion.

This last mentioned item, lubrication, has a very important bearing upon the life of the tools, the quality of the product and in some cases the ability to extrude the material. In fact, it was a revolutionary development in the lubrication phase of extrusion which aroused the interest of the steel industry in the extrusion process as an economical method of manufacturing steel shapes.

The news of the development in France of the Ugine-Sejournet process for extruding steel gained widespread interest among the steel fabricators in this country. This process employs a glass composition as a lubricant for the extrusion of steel and high temperature alloy billets. The glass composition is applied on the billet and tools prior to extrusion. The results obtained were far better than anything which had been done up to that time. For one thing, tool life was increased considerably and the economic advantage of using the extrusion process for producing steel shapes became real. The process made possible the extrusion of shapes which normally would have ruined the die after one or two extrusions. The surface quality of the extruded sections was exceptionally good, and a high degree of dimensional accuracy was obtained.

As a result of this development, three of the largest Americal steel fabricating companies ordered the design and construction of extrusion presses and allied equipment for installation in their plants.

An important contribution to the development of the extrusion process for high temperature steels and alloys was the introduction of salt bath heating. In fact, the salt bath furnace is employed in the Ugine-Sejournet process to heat the billets to temperatures up to 2300 F prior to applying the glass lubricant. Besides giving a

scale-free surface, which in extrusion is very important, the layer of salt which adheres to the surface of the billet also acts as a lubricant.

In the early part of 1949, the Industrial Planning Division of the Air Materiel Command took over an extrusion plant in Adrian, Mich., which was built in 1943 for the extrusion of light metals, and converted it into a manufacturing methods pilot plant. This plant contains 16 extrusion presses ranging in size from 1650-ton capacity to 5500 tons. The purpose of the plant was to allow the military forces and industry to conduct experiments on these presses.

The first experiment to be undertaken in this plant was the development by the Curtiss-Wright Corp., propeller division, of a mass-production method for the hot-extrusion of hollow steel propeller blades. The extrusion was carried out on a 5500-ton extrusion press originally designed for light metals. On this press a 320-lb chrome-nickel-molybdenum steel billet was extruded in three steps into an integral shank, and a 10-ft long propeller blade with "ears" running from the shank to the tip. The wall of the tube is tapered on the inside from $\frac{3}{8}$-in. at the shank to $\frac{1}{8}$-in. at the top.

For this experiment, an electric salt bath furnace capable of heating approximately 1400 lb of steel per hr was employed for heating the billets prior to extrusion. The adhering layer of salt combined with the mixture of a graphite and oil base, which was used to swab the tools and the liner of the container, served as the lubricant. The tools were made of essentially the same composition steel as was used for the nickel and nickel alloy extrusions described previously. However, the dies were hard-faced with a cobalt-chromium tungsten alloy in order to prolong their life and minimize the tendency to "wash out." The billets were heated to a temperature of 2250–2300 F prior to extrusion.

Prior to the development of this extrusion method, these same propeller blades were made by welding, brazing and forming specially processed flat plates, weighing 750 lb before machining. According to Curtiss-Wright's figures, the saving on material alone by using the extrusion method will amount to approximately 3000 tons monthly which in the old method are lost in chips.

In addition, the quality of the extruded blade is better. The extruded steel has a tough, homogeneous structure and better physical properties.

Our company is conducting for the Ordnance Department a development program for the extrusion of 20-mm, 57-mm, and 75-mm, gun tubes. These tubes will be extruded from nickel-chromium-molybdenum steel billets on a 2750-ton and 3850-ton extrusion press. It is our belief that these experiments not only will show a savings in materials and fabricating costs, but they will also indicate that gun tubes can be made from steel alloys containing less of the strategic materials because of the better physical properties obtained through extrusion. The billets will be heated in a salt bath furnace to a temperature of 2300 F prior to extrusion. In the selection of steels for our extrusion tools, we have departed somewhat from past practice by using for our dies a 5 per cent chromium hot work steel having no tungsten. We thus hope to be able to greatly minimize the tendency for the die proper to crack which seems to be inherent in hot work tool steels containing tungsten. The dies are hard-faced with a cobalt-chrome tungsten steel for wear resistance.

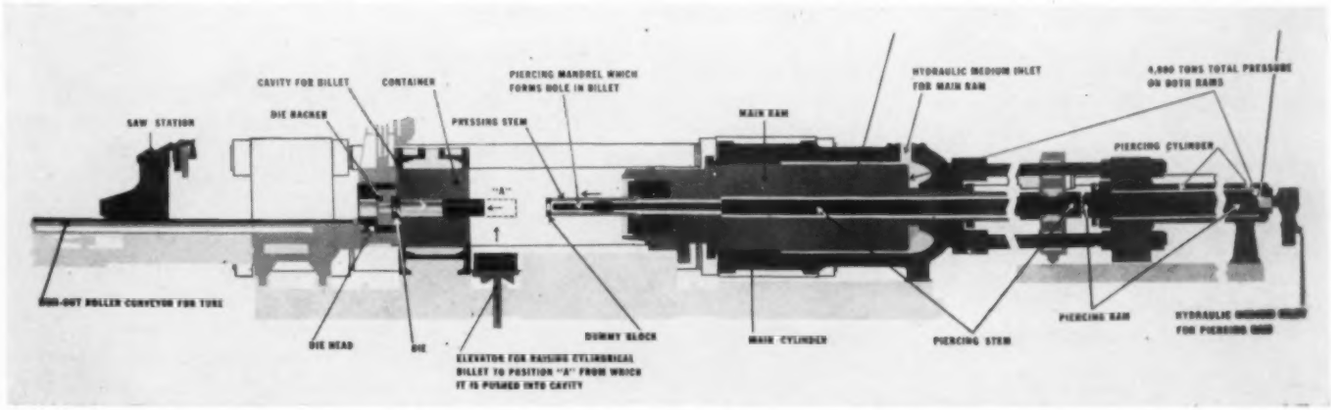
The 20-mm and 75-mm gun tubes will be extruded in one operation each. Because the 57-mm gun tubes have three different diameters, they will be extruded in two operations.

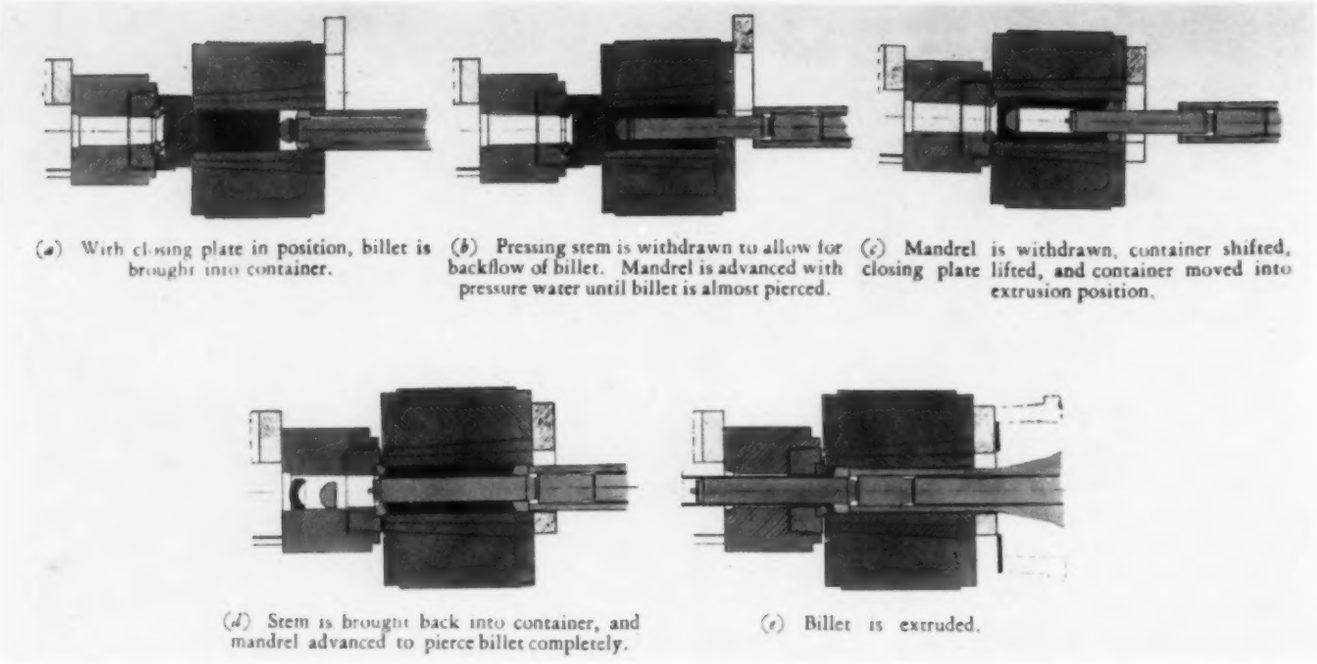
In order to avoid the straightening of the gun tubes after extrusion, special guiding devices which we had designed previously will be mounted on the run-out table of the extrusion presses. The guiding devices will serve to keep the extruded portion of the gun tubes straight as it comes out through the die.

A number of other developments in hot extrusion of metals is taking place at the manufacturing methods pilot plant and elsewhere. Unfortunately, the writer is not at liberty to discuss these developments in detail. Briefly, these developments concern:

1. The extrusion of 18–13 stainless steel tubing 2.5 in. in diam with a wall thickness of approximately $\frac{3}{16}$ in. from 9-in. diam hollow billets. Twenty-six ft tube lengths have been extruded in approximately 4½ sec. The extrusion is being carried out on a 3850-ton horizontal extrusion press.
2. The extrusion of multi-hole aluminum tubes from solid billets. Tubes are extruded through a spider die and the variation in wall thickness is kept to a very close tolerance.
3. Extrusion of solid aluminum billets into tubes with internal fins along the length of the tube.

Figure 2 — Cross-section of a modern tube and rod extrusion press.





(*a*) With closing plate in position, billet is brought into container.

(*b*) Pressing stem is withdrawn to allow for backflow of billet. Mandrel is advanced with pressure water until billet is almost pierced.

(*c*) Mandrel is withdrawn, container shifted, closing plate lifted, and container moved into extrusion position.

(*d*) Stem is brought back into container, and mandrel advanced to pierce billet completely.

(*e*) Billet is extruded.

Figure 3 — Steps for the extrusion of large tubes are shown in this operation diagram.

4. Extrusion of the newer commercially developed pure metals, such as titanium, molybdenum, zirconium and beryllium into bar, rods, tubing and more complicated shapes.
5. The extrusion of a special Timken alloy 16/25/6 with Cr, Ni, Mo content into tubing. This alloy which is considered highly refractory and difficult to forge was extruded experimentally with high promise of success.

The expanding application of hot extrusion to cover high temperature metals and alloys, and the increasing complexity of shapes which can be more desirably produced by extrusion, make it evident that the need has arisen for extrusion presses larger than any which have been built in this or any other country.

In February, 1950, the writer addressed representatives of the Munitions Board and the armed forces on the production of large airplane sections by means of hydraulic forging and extrusion presses. At that time it was shown that the two spars of an airplane wing could be extruded at one time on a 25,000-ton extrusion press, the largest size press ever planned. The design of this press together with that of a 75,000-ton and 50,000-ton forging press is well under way. In addition to extruding complete airplane parts, the 25,000-ton extrusion press will be used to pre-work cast billets prior to forging parts on the 75,000-ton forging press. Through the use of these presses, tremendous savings in manpower, machine time, and materials will be effected. Equally important, the parts thus produced will have a better physical and metallurgical properties and will permit marked reductions in the weight of our planes.

Some of the work which was carried out recently leads us to believe that a wider interpretation will have to be given to the term "extrusion."

Not long ago, "extrusion" or rather "hot extrusion" meant the production of simple or of complicated shapes which were essentially of constant cross-section. More recently, however, variations have been introduced, such as the so-called stepped extrusion by means of multiple die-locks, the extrusion of sections with continuously varying thickness, and the extrusion of sections which consist partly of a pre-forged or formed part, which is integrally connected with an extruded portion of appreciable length. The extrusion of propeller blades, to which we referred earlier in this paper, presents an interesting example of the last-mentioned alternative, whereby the long extruded section has in addition a decreasing wall thickness.

The possibility of producing such shapes offers new and challenging perspectives, since it increases enormously the realm of application of the extrusion process, which heretofore was considered mainly a means for producing long pieces of constant cross-section.

Whether or not such complex pieces can be produced in "a single heat," or require several operations is a matter which will have to be solved individually. In treating such problems, not only has the plastic flow of the work-piece to be considered, but also the necessity of rapid and accurate changes in the tooling, when switching from one forming condition to the next one, and the necessity of certain tools to longer withstanding the influence of heat and of pressure without premature deterioration.

Such accomplishments require the combined efforts of designers to build special-purpose extrusion presses, of tooling engineers and of metallurgists. We have good hopes that these efforts are forthcoming.

We believe that the intensive research and development in the creation of special high-heat resisting alloys and of high-temperature lubricants, which also partly act as heat-insulators will greatly benefit this phase of metal molding, and that the extrusion process in its many variations will find increasing application and render increasing service to the steel industry.

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DISCUSSION

PRESENTED BY

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R. M. REICHL, Vice President, Hydropress, Inc., New York, N. Y.

WALTER R. CLARK (Retired), Bridgeport, Conn.

LUDWIG K. SCHUSTER, Chief Chemist, Heintz Manufacturing Co., Philadelphia, Pa.

M. D. STONE, Manager of Development, United Engineering & Foundry Co., Pittsburgh, Pa.

W. A. Dickinson: Mr. Loewy has admirably and concisely summed up the major recent developments in the field of extrusion and pointed out in general the promising future that lies ahead for it. However, I believe that in order to fully appreciate the true import of these developments, we should look back and review the situation before the twin developments of (1) Ugine-Sejournet process of glass lubrication, and (2) the recognition of the critical importance of proper heating conditions for the extrusion billets. In brief, we can say that commercial high temperature extrusion in the U.S.A. has been confined to the nickel and high nickel alloys, and the reason these materials could be successfully extruded is that they are basically non-scaling materials. They therefore could be extruded, using conventional atmosphere furnaces and lubricants. However, even in these alloys we were limited to what in the eyes of the brass and aluminum extrusion industries were regarded as very low extrusion ratios, and because of the affect these refractory alloys had on dies, we were also limited to very simple shapes. Now all this is changed, for presently due to the recognition of the two developments above, it should be possible to successfully operate at extrusion ratios three to four times higher than those previous employed, and undertake with confidence the extrusion of relatively complex shapes. Further, the extrusion of ferrous materials is now being undertaken by several companies on a commercial basis. This means that extrusion has now entered the high tonnage field where, in the interests of high productivity, attention will be focused on design of press and handling equipment. This in itself will constitute a considerable advance and bring new concepts for the application of the extrusion process.

These advances in the extrusion of tubing and sections, when taken together with such special applications as the production of stepped or varying outside and inside diameter extrusions and the production of clad or lined tubing and bars having a metallurgical bond between the materials, strongly substantiate Mr. Loewy's prediction of a rapid and great expansion of the use of extrusion.

G. A. Pugh: It would be remiss not to mention other early work particularly as it affected the first commercial extrusion of ferrous metals. During the early 1930 period the Mannesmann Tube Co. at Witten, Germany placed in operation an 800-ton mechanical press designed along the lines described in Dr. Singer's patent. This tube extrusion press was vertical, and round steel billets were heated in a conventional roll down furnace, passed through a cross roll type rotary sizer then dropped into the press container and pierced and extruded in one stroke of the press. This original press has been discarded and supplemented by two larger presses of the same general design, which are in operation producing seamless merchant pipe and stainless hollows for subsequent processing by tube reducing methods. In mechanical extrusion, lubrication methods have progressed but essentially the use of graphite, oil and salt prevail which becomes objectionable where carburizing may take place.

One real advantage in the mechanical press has been demonstrated, namely high speed extrusion. The hydraulic presses now being built will attain similar high speeds which are important for stainless tube extrusion.

There are other developments to be explored in the use of glass as a lubricant or insulating vehicle and particularly in the use of American made glass products. The companies licensed under Ugine-Sejournet patents are alert and active in this new field and many improvements can be expected as experience leads to wider horizons.

R. M. Reichl: Mr. Pugh mentioned the mechanical presses and the good work which they have done over a period of years. It is interesting to know that they have been running these presses at Witten on a production basis, and that these presses have been turning out salable material which has been going through tube reducers to be converted into standard size pipes.

It is, however, also a fact that due to the lubrication method, that the tool life on these mechanical presses was comparatively short, and that in an attempt to prolong tool life, tubes were extruded which were comparatively thick in wall, and which had to be sent through the tube reducers to get the necessary thin wall. Now, on the basis of the work that has been done in France, we confidently expect that the hydraulic presses which are being built in this country will produce tubing of wall thickness such that we will not have to rely on tube reducing action to such an extent, and that, at the same time, the tools will stand up well; that we will have comparatively little expense on the tools, which is important, since the expenditure on tools in hot working processes is usually one of the major expenditures if you consider labor and tools only.

There is another fact which has to be kept in mind, and that is a rather fundamental one, that the speed curve of a mechanical press is fundamentally unsuited for use in the French process. I do not see at present how it would work well with that. It may work well with other types of lubricants at present, but not with the lubricant which is contained in the French patent.

I believe that hydraulic presses with their possibility of modifying extrusion speeds in accordance with con-

ditions, are far superior to the mechanical ones since their sine curve can be modified only with great difficulty.

Walter R. Clark: Mr. Loewy has ably described the rapid advancement in the art of extruding hard ferrous alloys since the original experiments carried out at the Bridgeport Brass Co. plant on the first Loewy extrusion press built and installed in the U.S.A. Data obtained from tests on hard ferrous alloys made on this 2250-ton tube extrusion press were very useful in developing the design of the 4000-ton press installed at the International Nickel Co.

The growth of extrusion of hot refractory metals has always been dependent on the limitation of tools capable of withstanding combined high heat and pressure.

The non-ferrous industry uses, at times in extruding its harder alloys, temperatures up to 1900 F, at pressures up to 100,000 psi of billet area. These alloys are limited to comparatively low ratios of billet area to die area, due to the fundamental law of resistance to deformation. That is, the pressure exerted on the billet in the press container increases as the log of billet area to die area. It also increases with the billet length due to extra friction to be overcome because of billet length and extra heat lost through conduction to the walls of the container.

As the pressure increases, the work done per unit volume of billet increases and its temperature is increased. This, when extruding hard alloys heated to near the melting point, may result in a temperature increase sufficient to cause incipient melting of the metal leaving the die. This results in cracked or completely fractured sections.

Slower extrusion, permitting greater heat loss to container and die, and requiring less pressure to overcome plastic resistance to extrusion, may lower the temperature sufficiently to overcome this, but usually the most effective remedy is to reduce the ratio of billet area to die area. Some brass alloys can be extruded with ratio of billet to die of over 200/1, while other non-ferrous alloys that are extruded commercially are limited to much lower ratios of the order of 50/1.

The announcement of the Ugine-Sejournet process developed in France should greatly accelerate the use of extrusion in the forging of steel, ferrous alloys, and other metals difficult to forge. Scale is very destructive to tools in ferrous extrusion, and the elimination of oxide through salt bath heating, and the reduction of friction through the adherent glass lubricant should permit lower extrusion pressures and higher extrusion speeds, which will in turn result in less heat built up in container, dummy and die.

The extrusion process is one in which all forging is accomplished with the entire billet subjected to compressive strains and it should be possible to extrude many alloys normally considered "hot short." As an illustration, ordinary screw machine grade of brass can only be worked hot, by extrusion, because of the lead content.

The completion of the 25,000-ton extrusion press and the 50,000 and 75,000-ton forging presses will place the U.S.A. well in advance of the rest of the world in extruding and forging large sections of hard alloys.

Ludwig K. Schuster: I am wondering if molybdenum-disulfide will ever replace graphite in hot extrusion, or whether molybdenum-disulfide was ever tried to replace it?

R. M. Reichl: Molybdenum-disulfide has been tried as the lubricant in hot steel extrusion, and has been used successfully. As far as our work with it was concerned, or in our experiments we are satisfied with its properties. We do not see it as an all-out cure, but it certainly represents an appreciable step in the right direction.

M. D. Stone: I would just like to add a word to Dr. Reichl's remarks about hydraulic vs mechanical extrusion presses. In the current air force program several big extrusion presses are being contemplated ranging up to 25,000 tons, and the stroke requirements are such that mechanical presses cannot be considered at all—going up to several feet in many cases.

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HEAT RELIEF IN INDUSTRY

By BARTLETT R. SMALL
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. . . . radiation probably is the major factor in producing discomfort due to heat . . . . fortunately, shielding can often markedly reduce such radiation . . .

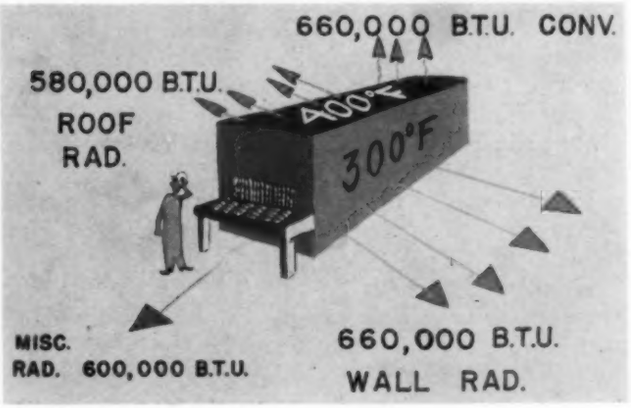
▲ SITUATIONS often arise that require more effective heat relief for personnel around furnaces and mills than is commonly practiced. Any methods that can produce somewhat less cooling effect than refrigeration, but are more effective than ventilation, show promise of growing acceptance. Between these two extremes lies the field of heat abatement that is discussed in this paper.

As the logical first step in cooling hot areas, building ventilation rates can be economically increased by use of stream-lined continuous monitor ventilators and high capacity powered fan roof ventilators.

Recently developed methods of radiant heat shielding by means of semi-portable reflective sheet metal curtains have created considerable enthusiasm. In the glass industry, no other method has approached the effectiveness and low first cost of radiation shielding. Special forms of personnel shielding include reflective clothing, and even reflective facial creams for hot repair work.

Severe conditions that fail to respond to shielding have been relieved by a third step, known as local or spot cooling. Ships have long depended on spot cooling in the engine and boiler rooms.

Figure 1 — Typical furnace heat escape to building shows about 70 per cent radiation.



Today it is not too difficult to obtain cooled air for serious trouble spots; washed air, unrefrigerated but cooled by evaporation, can be delivered from grilles at 75 to 80 F when it may be 90 F outdoors. Other industries, having more severe heat exposures than steel or aluminum operations, have installations totalling many million cfm of evaporatively cooled air.

The troublemaker in a hot area may be molten metal, semi-finished metal or a furnace. The magnitude of radiant heat release from hot carbon steel ingot is seldom realized. The following comparative values are examples (based on surroundings at 100 F mean radiant temperature and surface emissivity of 0.9):

2200 F ingot	—	77,000 Btu per sq ft per hr
1900 F ingot	—	49,000 Btu per sq ft per hr
400 F furnace shell	—	700 Btu per sq ft per hr
200 F steam radiator	—	176 Btu per sq ft per hr

This 2200 F ingot releases by radiation alone the equivalent of almost 3 boiler horsepower for every square foot of ingot surface.

The walls, roof and doors of either an open hearth or an ingot preheating furnace may release to the enclosed building about 10 to 20 per cent of the fuel input.[1]* For example, an ingot preheating furnace 10 × 10 × 80 ft with 20,000,000 Btu per hour input, may release about 2,500,000 Btu per hour, the equivalent of three large blower type unit heaters common to steel mill buildings today.

The convection component in Figure 1 refers to the hot air currents that rise and give the least trouble; but the other 70 per cent of the total heat escape is radiation which heats every surface within visible range. Receiving surfaces such as structural steel, building walls, accessory equipment and adjacent machinery all become heated and actively reradiate in turn.

An illustration of this heat magnitude is the fact that a line of such furnaces, with the aid of solar heat, can frequently produce a 120 F surface temperature on the

* Numerals refer to Bibliography at end of article.

Figure 2 — Heat conditions are shown at end wall of billet heating furnace.

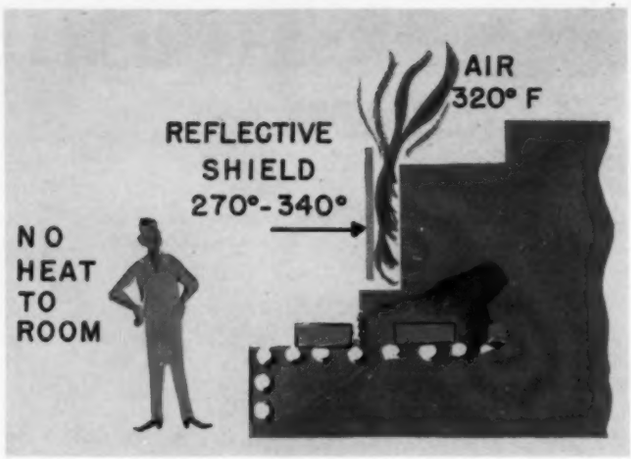


Figure 3 — Shield was added as shown.

roof underside in summer. If it were possible to maintain this temperature over the entire area in winter, there would be enough panel heating capacity to take care of the whole heating load for a well-constructed building in zero weather.

Recognition of high temperature radiation as a major source of discomfort is creating new avenues for securing improved heat relief. Attaining the comfort level of outside weather with radiant heat control seems improbable, but definite relief is possible, as those who have successful installations can attest. Radiant heat control has appeal because of the very low first cost, the absence of any mechanical equipment or moving parts and its grass root type of effectiveness.

An experience last summer with a typical billet heating furnace, operating with conveyor chain and billets at 700 to 900 F, is an excellent illustration. There was a serious heat condition because of radiation from hot objects on three sides of a 12-ft square working quadrangle. The surfaces of the conveyor tunnel doors and end wall ranged from 500 to 600 F (Figure 2). A plain aluminum sheet was taken out of the plant metal stores, sheared to size, and clamped in position as shown in Figures 3 and 4. Before shielding, the 500 F furnace end wall had a calculated emission of about 1300 Btu per hr per sq ft. The reflective shield, in spite of being heated by combustion products to about 300 F, emitted at the very nominal rate of about 33 Btu per hr per sq ft because of its 0.90 reflectivity.

As a side effect, the incoming draft of cool air that rising convection currents always create became noticeably pleasant as a result of the lessened radiant heat. A few days later a plant engineer reported the men were saying that, "This shielding is the best thing they have ever done for us." This one sheet with its radiation arrestance did more for the men than man-cooling fans and, apparently, more than a battery of powered roof ventilators directly above. All the furnaces in this row were equipped soon after and the cost was less than $100 each.

Perhaps the Dewar flask first drew attention as a means for minimizing heat transfer. The flask's silvered surfaces practically eliminated transfer by radiation, while convection and conduction were reduced by the use of a high vacuum. This developed into the common thermos bottle.

In the case of an industrial furnace, the hot walls, roof and especially the doors are actively emitting energy in all directions. This invisible energy can be intercepted by an opaque surface and then transformed into heat. But heat radiation cannot be stopped from highly emissive surfaces as long as there are surrounding colder receiving surfaces. The receiving surface, however, need not be human bodies nor the surroundings. If the receiving surface is brought close to the hot object, it becomes known as a radiation shield.[2]

An intervening air space must be present or the shield will heat by conduction; i.e., metal to metal heat path and a thermal short circuit. The shield effectiveness depends on the reflective qualities of its surface. It can be said that a good reflective surface keeps cool in the presence of high temperature radiation.

All metals are basically good reflectors for infra-red radiation, i.e., if the surface is clean and free of thick oxide films. Tarnishing and rusting may destroy the reflective qualities of mild steel and copper. Galvanized iron is affected less, and stainless steel and aluminum only slightly. On the other hand, the surfaces of nonmetals have poor reflectivity and are highly emissive. In fact, their emissivities range from 0.85 to 0.95 of a perfect black body, and they absorb and emit heat readily.

Surfaces of many materials may be given reasonably good reflective values by the application of reflective paints. A new class of high temperature aluminum pigment paints having silicone or modified silicone bases can withstand 1000 F surface temperatures for extended periods. The good reflective qualities and spray-painting characteristics place it conspicuously in the picture as a means of radiant heat control. Such paints can eliminate two-thirds of the radiant heat normally radiated, as compared to good reflective surfaces that can eliminate ninety per cent.

Shielding obtained some rather startling results at an open hearth type of furnace used for remelting aluminum throughout the industry. The steel casing of a furnace read 280 F. A $\frac{1}{16}$-in. thick sheet of ordinary mill finish aluminum was set out 6 in. in front of it and

clamped against the face of the vertical buckstays (Figure 5). This reflective radiant shield quickly came to equilibrium at the unusually low surface temperature of 85 F when the room temperature was 66 F in the winter time.[3]

The chimney effect of this unobstructed stack, bounded on the front by the shield of 8-ft effective height and open at the bottom, produced a 25 F air temperature rise. Sufficient cooling of the brickwork and shell was thus assured with the shell heating up only 10 F to 290 F. The possibility of overheating the brickwork and shell is a real one and should be checked by thermocouples on any new application of shielding.

Perhaps the outstanding installation to date was made by one of the leading glass companies which totally shielded several glass annealing furnaces on all four sides. Because of the large heat release and a low roof, the shielding sheets were extended up to the roof where ventilators were selected to balance the requirements. Their method of mounting the shields is considered an essential feature. Threaded studs were welded to the columns using a stud gun, and sheets can be removed when necessary by removing wing nuts. Millwrights do not object to shields that can easily be removed and restored.

Materials with surfaces best suited for radiant heat shields are those that maintain high reflectivities for radiant heat and low emissivities under plant conditions.

All indications are that demountable reflective shields will be increasingly used, particularly for protection of specific working and operating areas near furnaces and hot metal. On the other hand, high temperature reflective paints will soon be furnished by more furnace manufacturers as a single coating that may suffice for combined shop and finish coat for furnace structures, shells, doors and door frames as a standard practice. Auxiliary equipment installed in the immediate vicinity may also be given this treatment to great advantage.

Spot or local cooling is the other important means of accomplishing industrial heat relief. This method might be divided in three classes:

1. Recirculated room air driven by mancooler or pedestal fans.

TABLE I

Emissivities of Various Materials[4]

Material	Temperature of surface measured	Total normal emissivity
Aluminum foil	100 F	0.03
Aluminum sheet, clean	100 F	0.07
Aluminum sheet, oxidized at 1110 F	100 F	0.11
Aluminum paint, approved type	100 F	0.30-0.35
Steel, polished	100 F	0.07
Steel, oxidized	100 F	0.79
Tin, polished	200 F	0.05
Zinc, galvanized iron	200 F	0.07
Zinc, galvanized iron, dull	200 F	0.24
Brass, polished	100 F	0.05
Monel metal, not polished	200 F	0.16
Stainless steel	200 F	0.22

2. Raw outside air delivered by high velocity fans as a direct blow or through a duct system and grilles.
3. Outside air cooled by evaporation and in most cases conveyed by ductwork to permit reduced air volumes.

The mancooler fan is highly valuable in hot industries located in the middle Atlantic and upper Central States when the environment involves limited radiant heat and where room air remains below 90 or 95 F. Its contribution diminishes seriously in areas of 100 to 105 F air temperature. Physiologists report that a man's skin temperature is maintained at 92 to 94 F by the body temperature control system, and any exposure to rapid air motion at elevated temperatures contributes to body overheating through convection.

By the same yardstick, fan driven, outside air is a useful means of mancooling, and is most valuable for hot operations located near outside walls. In wide buildings, deficient of cross circulation in the interior areas, or in windowless buildings where semi-skilled work entails little motor or furnace heat liberation, roof

Figure 4 — Actual reflective shield in place.

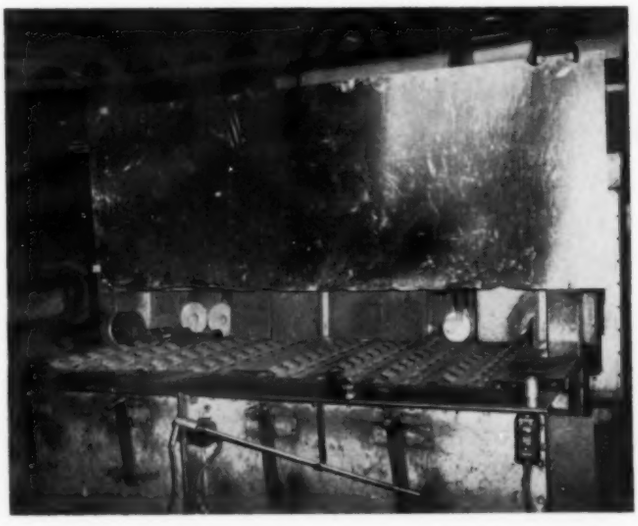
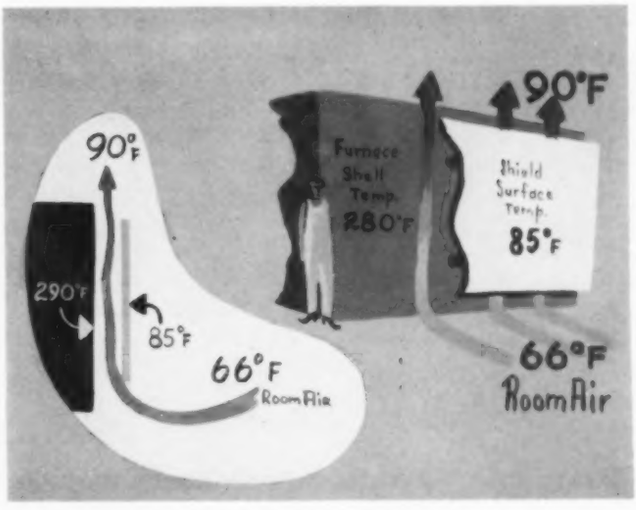


Figure 5 — Shielding results at shell of remelting furnace



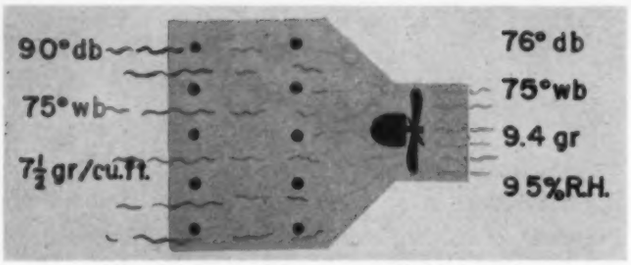


Figure 6 — Evaporation cooling air washing.

supply fans that blow downward with air distribution controlled by a ceiling diffuser are finding wide acceptance.Total first cost of 6¢ to 8¢ per cfm in new buildings is obtained. For large, hot areas that require ductwork, it has been the attitude that raw outside air as such is not worth the investment of 15¢ to 30¢ per cfm, because of the lack of temperature difference and absence of cooling effect.

When the mancooler fan or the raw outside air fan becomes a hot blast and reaches a temperature of 100 F or higher as pointed out, it is no longer valuable. It is true that the air motion of perhaps 300 fpm or even 1500 fpm (about 16 mphr) does produce increased evaporation on the skin surface and the skin is cooler. However, continued profuse sweating is undesirable and may deplete a person's vitality. Even though the evaporation of sweat from skin surface is the best cooling mechanism, it should not be given the entire task of battling man-made heat exposure. In a noon-day crossing of Death Valley in an open convertible, for example, both radiant heat and a hot blast air stream are well represented. To say this is strenuous, is putting it mildly, for a person is exhausted without even doing any physical work.

The major cooling system of the fuel-burning human body, is the vascular or blood vessel structure of the skin surface. If the body can be swept by air having some 10 or 15 F cooling differential, then nature's preferred cooling process, that of thermal equilibrium by convection, Table II, is restored.

Evaporative cooling is a simple non-refrigerating method of lowering the temperature of outdoor air to meet this demand for efficient spot cooling, Figure 6, which is not to be confused with space cooling. This

Figure 7 — Evaporative cooling requires supplementary ventilation.

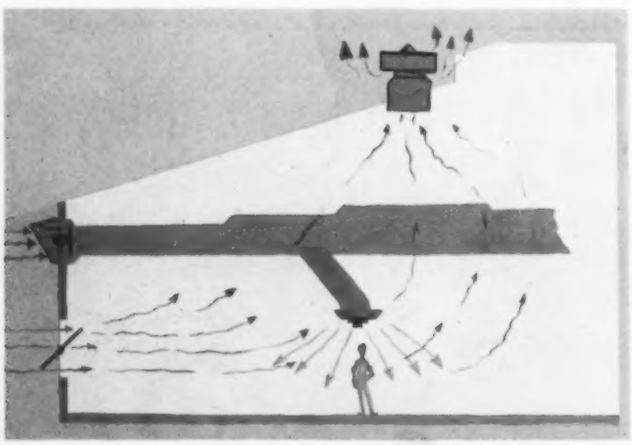


TABLE II

Comfort Index of Air Motion and Effective Temperature(5)

	Still air	300 fpm	700 fpm
Outdoors			
95 F dry bulb, 78 F wet bulb....	84½	82	80
Evaporative cooling			
82 F dry bulb, 80 F wet bulb....	81	77	73
Mill air			
105 F dry bulb, 80 F wet bulb...	88	86½	85
Air conditioned office			
80 F dry bulb, 67 F wet bulb....	74	70	68

specialized form of ventilation is obtained by the passage of outdoor air through an air washer and the resulting evaporation lowers the air dry bulb (ordinary thermometer) temperature and the sensible heat phase. A conversion to latent heat takes place and the moisture content of the air increases. For the performance described herein, this heat interchange is adiabatic; i.e., no heat is extracted by well water or refrigerative cooling.

The same spray water is recirculated without waste and its temperature remains the same as the wet bulb temperature of the entering outdoor air. This wet bulb value, incidentally, is the temperature that the weather bureau never gives out in reports, even though it is valuable as the measure of total heat of outdoor air and is the best ready index of summer comfort. The 75 F design wet bulb for summer given by the ASH&VE Guide for Chicago, and by coincidence also for Cleveland and Pittsburgh, is rarely exceeded. Air leaving the washer should be not more than one or two degrees warmer than the spray water, rarely exceeding 77 F for those three districts. This maximum saturation is recommended because the cooler air can offset a 3 to 6 degree heat pick-up in the ductwork at hot areas and still be effective. Incidentally, ducts built of a reflective metal such as aluminum absorb less room heat, and duct insulative coverings have been avoided by the use of this material in various furnace rooms. Heat pick-up is further reduced by using comparatively high trunk duct velocities, averaging 3000 fpm.

Four simple precautions are suggested in order to avoid improper practices:

1. Use all outside air and never recirculate in hot weather.
2. Maintain adequate air motion around the men who are to be benefited. Though not scientifically developed, a minimum of 300 fpm, ranging to 1000 fpm under severe heat conditions, has been found successful. Adequately equipped air dampers that permit 80 per cent velocity turn-down are essential, thereby extending the system's usefulness to spring, fall and often winter, if room air is recirculated during these seasons.
3. Provide a split system whereby evaporative cooling is used in combination with motorized roof exhaust ventilators and sufficient fresh air inlet openings. In this way the two to five-fold greater volume of raw outside air holds down the overall temperature level in all areas of an obviously hot operation and sweeps out the spent washed air, Figure 7.

4. Avoid application of evaporative cooling to offices and any areas free of hot operations except in recognized hot dry climates, of which the Southwest is typical. Offices require space cooling, whereas this study involves spot cooling in an environment of abnormal, sensible or radiant heat.

The writer's experience in installing central station air washer systems for combined humidity control and relief cooling in a number of Southern textile plants leads to the feeling that a resultant 60 to 70 per cent relative humidity room air in still air areas is not comfortable at moderate work rates. This is the reason for recommending a split system. The installation of excess exhaust is the natural thing to do in a large building, since air changes using simple outdoor air are more economical for the greater part of the building, with evaporative spot cooling judiciously reserved for severe heat exposures.

Exceptions to the split system are mill motor rooms, direct mill motor cooling, internal combustion engine rooms and electrical control rooms because rapid air changes provide adequate air motion. In this field there is an increasing use of air filter washers for the combined purpose of obtaining dust-free air and evaporative cooling.

Aluminum Co. of America's new fabricating plant at Davenport contains the second remelt furnace building to be equipped with evaporative spot cooling (Figure 8). It uses the split system with roof exhausters. The duct downcomers from the overhead supply duct have low level air diffusers located about 7 or 8 ft off the floor. The writer recently asked to have the supply fans shut off at this plant to see how soon the employees would complain. The chief engineer said no trial would be needed as he felt they would notice it in a minute. The air conditioned cab of rounded design, with chair for seated operation, can be seen in Figure 8.

This 1300 × 160-ft building is supplied with a total of 200,000 cfm of washed air in summer. In winter this amount of outside air is tempered to 65 F for make-up air to the various smoke, fume and dust exhaust systems in several interconnecting buildings.

Alcoa's first experience with washed air for spot cooling in typical production areas occurred in its Lafayette, Ind., fabricating plant. In 1944, a 600 × 160-ft remelting building, the counterpart of the open hearth shop, Figure 9, was to have much of its main operating side closed by the construction of two adjoining buildings. All fresh air and cross ventilation would be closed off.

A combination of circumstances seemed to justify evaporative cooling. The resulting two 80,000-cfm systems have been in operation for seven years, delivering 65 to 80 F air from the grilles during periods when other areas have reached 100 F. The men at the casting stations enjoy a 7 mphr breeze with air only 3 to 5 F warmer than back at the registers (Figure 10). This 7 mphr or 600 fpm target velocity is a function of 15,000 cfm discharging at 2000 fpm grille free area velocity and 30-ft travel that was calculated to have minimum induction of hot room air.

Another advantage is the system's ability to supply the Lafayette remelt building with the full 160,000 cfm of outside air in winter, tempered to 65 or 70 F to offset various exhaust system air losses. By reducing the building negative pressure, there are less cold draft

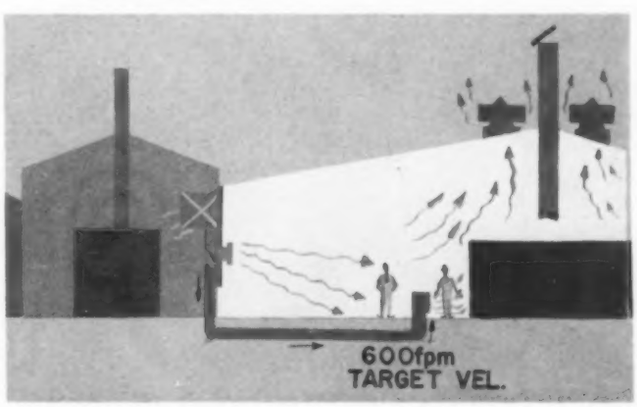
Figure 8 — Local areas are spot cooled by 100,000 cfm system.

difficulties around outside walls, particularly at truck doors. Many plants are following this make-up air practice.

The total installation cost at Lafayette amounted to $42,000 or 27¢ per cfm, even though the 440-ft run of outdoor duct was rather expensively constructed. The expenditure for this type of system seemed to be justified when this same plant recently sought and received authorization for a similar unit to serve a line of billet heating furnaces and hydraulic presses. The

Figure 9 — Good cross ventilation and circulation were obtained before buildings added.

Figure 10 — Overhead air supply was subsequently changed to underground duct.



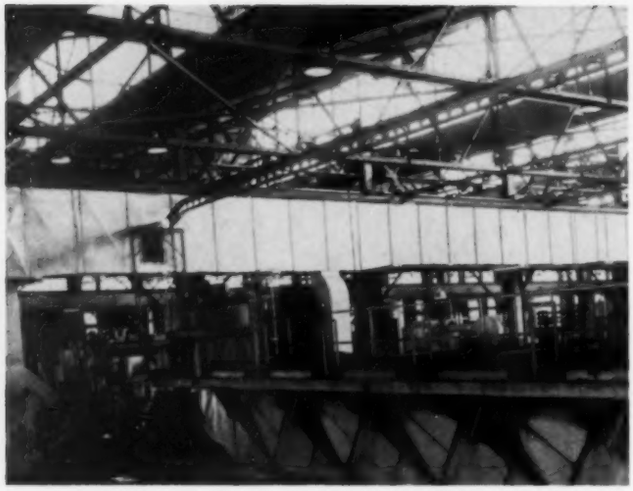


Figure 11 — Duct crosses 500-ft wide building.

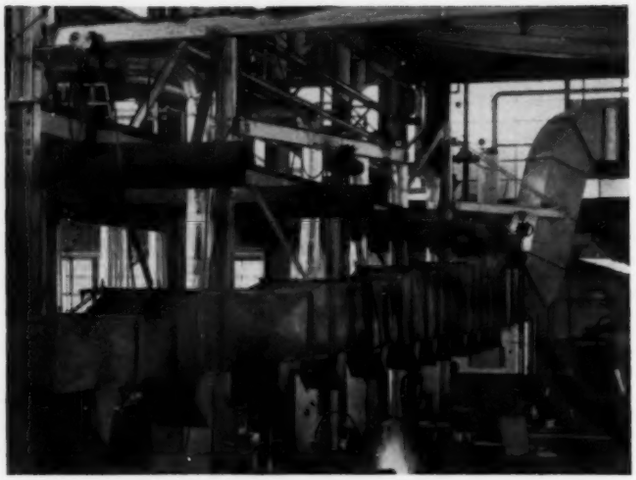


Figure 13 — Overhead duct and grilles serve twelve men.

building is 800 ft long, and the aluminum supply duct will run the full 500-ft width (Figure 11). About 35 operating stations are served by air volumes up to 4000 cfm with a system total of 82,000 cfm.

A typical prospect for spot cooling developed in 1949 when heat conditions became rather serious in a new small foundry engaged in turning out high production of permanent mold castings. The working area had air temperatures about 15 F above that outdoors, and radiant heat measured by a black globe thermometer showed higher values.

Gravity operated 54-in. roof ventilators exhausted air from under the roof; the air was about 35 F hotter than outdoors. By adding motors and fans, ventilation was tripled and a 4½ minute air change secured, helping the general temperature level.

At the same time, steps were undertaken to provide washed air and local cooling at the casting line. The photograph in Figure 12 shows a rather carefully developed but simple design. Each man receives about 2000 cfm or less, as he prefers, at an air velocity (grille free area) of 400 to 1000 fpm, with the natural air path directed to his waistline. On hot summer days the men are free to reach up and direct any desired part of the air on their shoulders and face, Figure 13.

The mistake of using a fixed grille and single air path was carefully avoided because of past experience. The lack of air pattern flexibility will turn the men against any type of air supply system. As proof, there are plants today where outdoor air cannot be blown on men without hearing a chorus of complaints. In practice, unless a man can easily change the air pattern and volume at will during the day, he will fight the system instead of being thankful for it.

Incidentally, after one summer's experience this same foundry went ahead and installed a duplicate system for another casting line. Shortly afterward, good reports from this plant led a second foundry to get an installation underway, Figure 14.

A recognized and successful pioneer in air conditioning expresses it very well when he said in part that outside air evaporatively cooled will provide conditions which meet from a physiological standpoint all health requirements at a price not much greater than adequate ventilation. In many cases evaporative cooling will provide conditions as satisfactory as refrigeration, and in every case safety from unfavorable reactions.

Alcoa has an aluminum producing plant in Texas that receives 120,000 kwhr from 120 generators driven by natural gas burning, radial engines. There is a story

Figure 12 — Permanent mold foundry.

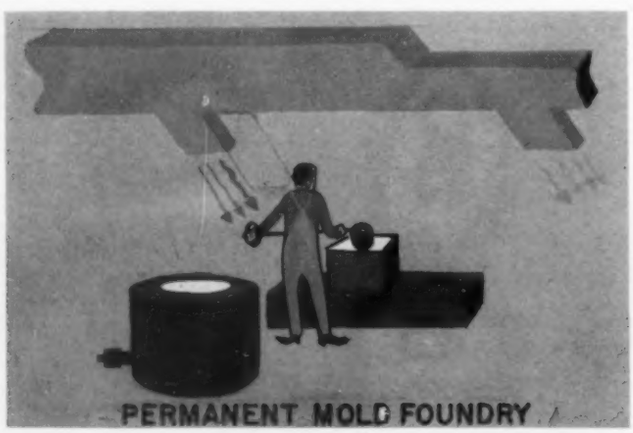


Figure 14 — Sketch shows ideal arrangement for maximum cooling efficiency and adjustments.

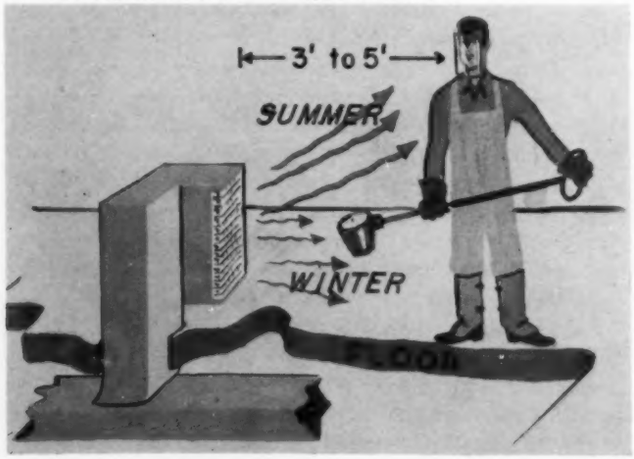


Figure 15 — Evaporative cooling is used for operating floor.

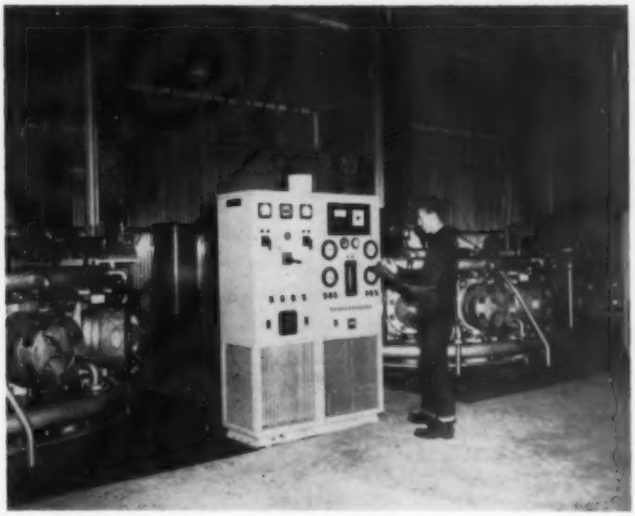


Figure 16 — Air grilles beneath filter tank can be seen in background.

here about the measures taken to keep the three engine buildings relatively comfortable while 40 hot engines are each turning out about 1600 hp in one large room. Figures 15 and 16 show a control cubicle in the middle aisle with air supply grilles on three sides down near the floor, from which about 10,000 cfm of cooled washed air is distributed in the working area around its respective engine. To assure good conditions along the outside wall areas, three air grilles are similarly located in the enclosed supporting stand for the oil filter that serves each engine. An air discharge of 6000 cfm is delivered here. All grilles operate at 1000 fpm free area velocity.

Grilles are thus delivering 16,000 cfm of pleasant air motion at 1000 fpm grille effective velocity over the 20 × 27-ft floor area given to each engine. Everyone is very pleased with the degree of heat relief obtained.

Incidentally, the 35,000 cfm air washer for each engine is also efficient as an air filter, using durable aluminum media in each scrubbing cell. Of this air volume that enters the continuous basement, 13,000 cfm is drawn through the 1000-kw generator windings and 6000 cfm by the scavenging air blower. This is a further application of considerable size based on a design that originated in an earlier group of engine buildings the company built during World War II, and which were equipped in a similar though less refined manner. This pilot plant approach is almost essential in the initial stages of spot cooling practice.

In closing this paper, a brief summary of reasonably safe procedure would be:

1. To look for every means to effect radiant heat protection in the area under complaint, a sort of heat control housekeeping. Shield or paint every surface over 200 F.
2. To ascertain if good roof ventilator or roof monitor practice and performance are being followed.
3. To spot cool with washed air those local areas in conjunction with the other two operations when more drastic relief is needed.

The only safe procedure is to learn to crawl before trying to walk, and the starting point should be small installations in several different plants. The results will speak for themselves and the stage will be set for heat relief when plans for a new plant shape up.

As a final word of caution, it is well to bear in mind that the adaptation of radiation control and evaporative spot cooling for various industries involve techniques that are still in the development stage. More important still is the lack of a good yardstick to predict whether an installation will be a success for what satisfies one superintendent may not satisfy another. Furthermore, it should be remembered that no professional field is more subject to wide personal interpretation than ventilation and heat relief.

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DISCUSSION

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Charles J. Enlind: Mr. Small's paper on the subject of heat relief in hot industries has considerable merit in that it promotes discussion on the subject of radiant heat control. Before going into details on the subject of radiant heat, it is advisable to give attention to mill building design so that high temperatures from convection heat can be removed as promptly as possible. Where high pitched roofs are used on buildings which contain furnaces or other hot operations, a continuous ridge type ventilator will usually remove much of the waste heat attributed to convection. To insure satisfactory results, especially in windy locations, it is suggested that these continuous type ventilators be constructed with cross baffles spaced at approximately 15-ft centers. This will tend to localize any end draft that may occur.

In some buildings much of the heat is confined to a few relatively small areas. It is then usually possible to install facilities for the removal of such heat directly at the source by means of hoods, ducts, fans, etc.

Radiant heat control, on the other hand, presents quite a different problem from that of convection heat. The use of radiation shields has been recommended where conditions permit. Protective clothing is sometimes used, but is often objectionable, as it frequently adds to the discomfort of the wearer.

Radiant heat can only be controlled by insulating or screening the heat sources and not by high air movement over these sources or by general ventilation, since cooling the air or increasing its velocity has no effect on radiant heat. The insulation of radiant heat sources besides being expensive in most cases, may be impractical, because it would interfere with the workmen who must have ready access to the product. The application of insulation against radiant heat is, therefore, limited.

Screening of radiant heat is relatively inexpensive and can be adopted in most cases. Furthermore, screening has the flexibility that insulation lacks, in that it may be either fixed or movable.

Excellent results have been obtained by using screens made of highly reflective material such as aluminum, tin plate, nickel, etc.

In many cases, screens have been made of steel or iron plates or chains which absorb radiant heat and convert much of it into convectional heat, the remainder being re-radiated at a lower temperature. Water cooled screens are also used in many cases.

The following applications of the reflective type of screens has been brought to our attention recently. In an open hearth department where a furnace was being repaired close to a furnace in operation, reports indicate that a reflective shield made of aluminum foil on asbestos was very effective in protecting the maintenance crew against radiant heat from the active furnace.

In reviewing several tests in which heat shields were used, it was noted in one test that an aluminum foil shield was placed 18 in. above molten steel which had a temperature of about 2800 F. In this case 88 per cent of the radiant heat from the vessel was reflected by the shield.

In another test, aluminum foil was placed in front of a furnace operating at 1300 F. In this case the back of the shield attained a temperature of 99 F when the room temperature was 65 F. At a distance of 1 in. behind the shield the air temperature was reported to be only 81 F.

Reports on these tests indicate that there was no sign of spalling when the foil was exposed 18 in. above the molten steel for 3 min or when placed 18 in. in front of the furnace at 1300 F for 3 hr.

It is believed that aluminum foil on fabric provides a good protective shield against radiant heat, but that the amount of reflectivity, and, therefore, the amount of protection afforded would decrease greatly with dirt accumulation on the foil surface. If such a radiant heat shield becomes discolored, it loses its effectiveness. Other materials than foil-on-fabric should, therefore, be given consideration.

Several kinds of sheets have sufficient reflectivity to warrant using them for radiant heat shields. Sheets of aluminum or a light gage 17 chrome stainless strip, such as that used for auto trim, would be suitable. The 17 chrome should be a cold rolled sheet having what is known as a No. 2 finish. This type will have sufficient reflectivity without polishing and has high resistance to oxidation at high temperature. In most cases a fairly rigid shield is required, and this can be obtained by using corrugated sheets.

Recent tests indicate that it would be advisable to experiment with shields of various designs, inasmuch as one that is suitable for one location would not be suitable in another place. When selecting material for radiant heat shields, care should be taken to avoid materials that oxidize readily when exposed to high temperatures.

The problem of controlling radiant heat should continue to be given attention. Studies could be made on the sustained reflectivity of various materials at prescribed conditions of temperature and dirt in order to determine the proper kind of radiant heat shield for use in various places.

Mr. Small's paper has opened the door to a large field of possibilities which justify further study on ways and means for controlling radiant heat found in various industries.

Allen D. Brandt: Mr. Small's paper of necessity is a very brief sketch of the subject matter. This is very unfortunate because any of the three aspects of the subject which he summarized so well might well occupy an entire session if covered adequately. Because the control of radiant heat by effective shielding produces such spectacular results at such small cost, I should like to add a little to this phase of the subject.

Even though the principles involved in radiant heat shielding are simple and well known to all of us, I will risk reviewing them briefly because experience has shown that they frequently are overlooked or ignored. Almost all solid materials are essentially opaque to radiant heat. Even ordinary glass transmits only a small percentage of the radiant heat in the range of wave lengths normally encountered in industry. Therefore, any solid material if placed between the object to be protected and all surfaces of elevated temperatures will prevent the primary radiant heat from reaching the object in question. However, most materials absorb most of this radiant heat, reflecting only little, and thereby become heated themselves. They then become secondary sources of radiation and heat the object which is being shielded. Thus much of the good done by cutting off the primary source of radiation is lost by virtue of the fact that the shield becomes heated and

in turn heats the object in question by radiation. Obviously, then, the best shield is one made of a material that reflects the radiant heat to the primary source and does not become heated itself. As pointed out by Mr. Small, there are several readily available materials which are good radiant heat reflectors.

So much for the first consideration in radiant heat control. The second consideration is that of keeping the amount of heat radiated by a shield to a minimum. The amount of heat radiated by a surface at an elevated temperature is a function of the temperature and of the radiating ability or emissivity of the surface. Obviously, then, in addition to keeping the temperature of the shield as low as practicable, the shield should be made of a material having a very low coefficient of emissivity. Many materials approach a "black body" insofar as radiant energy is concerned, that is, they absorb almost 100 per cent of the incident heat and emit at a similarly high rate. By using a shield with a high coefficient of reflectivity on the side toward the source of heat and a low coefficient of emissivity on the side toward the object being protected, a double-barreled effect is accomplished with the result that almost none of the radiant heat from the primary source reaches the object in question. Aluminum, for example, has a reflectivity coefficient of about 0.95 so that the temperature of an aluminum shield not in physical contact with a hot surface will rise only relatively few degrees above room temperature, and in addition, it has an emissivity coefficient of only about 0.05 with the result that almost no heat is being emitted or radiated by it. Because of its unusual characteristics in this respect, its availability, its convenience in handling, and its relatively low cost, aluminum is a singularly good choice for radiation shielding where interference with vision is of no concern. For windows or places where vision is important, special glass with unusually high reflective ability is now available.

It is important that the terms "reflectivity" and "emissivity" and the significance of them be appreciated fully if heat shielding is to be of most value. Also, it must be recognized that shielding is spectacularly effective only against radiant heat. If the problem is one of heating by convection, radiant heat shielding is of little, if any, value.

A few suggestions may be helpful in indicating where and how radiant heat shielding should and should not be used:

1. Radiant heat travels in straight lines in all directions from any hot surface, not only normal to the surface. Therefore, the shields must intercept all straight lines between the object to be protected and the hot surfaces.
2. Do not have physical contact between the shield and the hot body if it can be avoided. If there is physical contact, the shield is heated by conduction and only one of the two available "barrels" is operative, namely the low emissivity. In addition, the ventilation between the hot surface and the shield is reduced or eliminated with the result that convectional cooling of the shield is lost. Also, the hot body surface may increase sufficiently to cause rapid deterioration.
3. Do not forget that a good shield is highly reflective. For this reason, shields installed to eliminate one condition may create another. For example, if shielding is installed near to and along a motor room wall to reduce the heat load on the wall

Figure 17 — Radiation shielding is effected by means of corrugated aluminum at a rolling mill pulpit.

Figure 18 — Radiant heat reflective glass is used at a mill pulpit.

caused by hot metal stored or handled nearby, the radiant heat load on the opposite side of the hot metal is increased by the reflection from the heat shield.

4. Never install shields in such manner as to interfere with the natural ventilation through the area. To do so might create a worse condition even if the radiant heat load is reduced because the heat from convection will increase.
5. Radiation shielding is effective not only in increasing worker comfort, but also in increasing the life of motors, and other electrical equipment, and in reducing the heat load on certain air-conditioned crane cabs.

We have used both aluminum shielding and reflective glass on mill pulpits with excellent results. The use of this special glass is of recent origin but aluminum has been in service several years on crane cabs and at several very hot operations as well as at mill pulpits. The results are uniformly good in all instances where the heat load is primarily one of radiation. Figure 17 shows one of the shielded mill pulpits and Figure 18 shows a pulpit at which reflective glass has been installed but not aluminum shields.

A few examples will illustrate typical accomplishments.

By coincidence a study was made of inside surface temperatures in a pulpit at a 54-in. mill when aluminum had been installed in part. The pulpit straddles the conveyor between the soaking pits and the rolls. At the time of this study, aluminum had been installed beneath the entire floor of the pulpit and up the side toward the rolls to the observation windows, a distance of about 36 in. from the floor. The observation windows were thick, shock-resistant glass which terminated about 12 in. below the roof. The inside surface temperature of the roof was 95 to 105 F; of the floor, 95 to 100 F; of the wall toward the rolls beneath the windows, 85 to 90 F, and above the windows 140 F. This provides two excellent points of comparison. The inside surface temperature of the roof which receives no primary radiant heat was a trifle higher than the floor beneath which ingots were passing regularly enroute to the rolls. The metal wall beneath the windows on the side toward the rolls which was protected by aluminum was 50 to 55 F lower in temperature than that on the same side of the pulpit but above the windows and unprotected. What this means in terms of heat exchange is that the unprotected wall was radiating heat at the rate of about 56 Btu per hr per sq ft toward the occupants, while if the walls had all been at the temperature of the shielded wall, the occupants would have radiated heat at the rate of about 8 Btu per hr per sq ft toward the pulpit walls.

In another instance, the installation of aluminum beneath the motor of a 48-in. shear crane improved the life of the motor a great deal. Before the installation of the aluminum, the motor was replaced on the average of once every six weeks. Since the installation, it has gone two years without replacement.

Since the bulk of the heat load at many hot operations in the steel industry is produced by radiation, appropriate shielding provides a singularly effective and economical method of protecting men and machines from exposure to unnecessary heat loads. Radiant heat shielding furnishes the engineering and operating personnel in steel plants with an excellent tool for decreasing maintenance costs of certain equipment and for removing some of the sag from the hot weather production curve.

George F. Haines, Jr.: The scientific engineering thinking behind the development of ventilating and air conditioning systems is very impressive, but the application of these systems to the control of industrial heat exposure leaves much to be desired. These systems too often neglect adequate consideration of the radiant heat, which is responsible for approximately two thirds of the heat emanating from hot surfaces. It is absolutely necessary to distinguish between radiant heat and hot air because entirely different methods are required for their control. Hot air, we know, can be controlled by ventilation or air conditioning—radiant heat can only be controlled by screening or insulating.

Of all the uncomfortable heat exposures I have experienced in the steel and glass industries, I have never seen a case where radiant heat was not the major offender, yet thousands and thousands of dollars are spent year in and year out treating the hot air which

Figure 19 — The common industrial heat exposure illustrates the factors responsible for body heat balance.

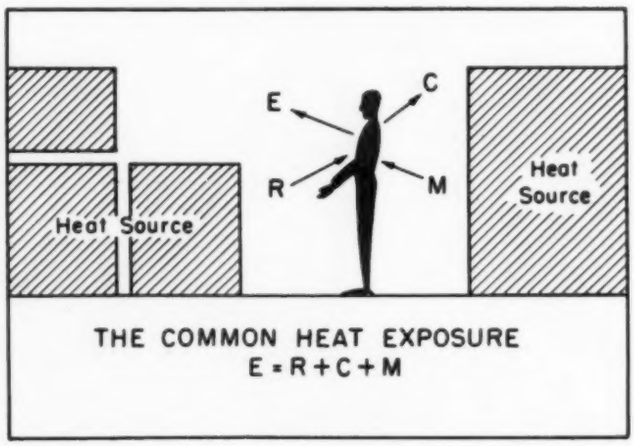

TABLE III

The relative contributions of radiation and convection to the total heat load imposed on man

Test location	Heat exchanges		Btu per hr total	Radiation per cent of total	Convection per cent of total
	Radiation	Convection			
D4	2550	1030	4530	56	23
D6	2190	570	3710	59	15
D7	1360	640	2950	46	22
D10	2390	1010	4350	55	23
D12	1390	540	2880	48	19
D15	1775	570	3295	54	17
D16	3110	590	4650	67	13
A11	3480	315	4745	73	7
A12	1940	120	3010	64	4
A14	2630	110	3690	71	3
A15	1775	120	2845	62	4

usually accounts for less than one third of the total heat load imposed on the man anyway. I have seen cases where it was obviously ridiculous to provide more general ventilation and so local mancoolers were improperly installed blowing 90–110 F air directly over the man at velocities as high as 1500 fpm; still the radiant heat, which was the major offender, continued to blaze on entirely uncontrolled.

Body heat balance is a physiological requirement for health, and the human body, like a physical body, lends itself to the analysis of this balance. Figure 19 illustrates the common heat exposure, the individual factors responsible for heat balance and the problem which exists—getting rid of by evaporation, E, the heat imposed upon the body by convection from the hot air, C; radiation from the hot solid surroundings, R; and the heat produced by the body itself, the metabolism, M.

There are four environmental factors which influence the interchange of heat between the body and environment and they are: (1) the air temperature; (2) air velocity; (3) air humidity and (4) mean temperature of the solid surroundings. To properly evaluate an industrial heat exposure an ordinary mercury thermometer, shielded from the radiant heat, will measure the true air temperature; a variety of meters are available for measuring the air velocity; a sling or aspirating psychrometer will measure the humidity and a globe thermometer will measure the mean temperature of the surroundings. It is then possible to determine the relative contributions of radiation and convection to the total heat load imposed upon the man.

Table III presents such an evaluation made by the Industrial Hygiene Foundation of industrial heat exposures in the glass industry. From such an evaluation an intelligent and practical heat control program can be planned.

To supplement this work an experimental radiant heat screening program was carried out on these heat exposures. These results are shown in Table IV. The radiation screens used were of the reflective type consisting of nothing more than aluminum foil tacked onto light wooden frames. The screens were then placed, wherever possible, between the man and the heat source and the improvement in environment measured.

A reduction of 50–75 per cent in the radiant heat load was effected by these simple and rather crude screens. To achieve an equivalent improvement by ventilation would have been impractical requiring approximately a 30 F drop in air temperature.

The importance of distinguishing between radiant heat and hot air cannot be overemphasized in the planning of a control program for industrial heat exposures.

TABLE IV

Reduction in the radiant heat load by simple screening (single sheet of aluminum foil)

Test location	Heat exchange by radiation Btu per hr		Per cent reduction in radiation
	Without screening	With screening	
D4	2550	840	67
D6	2190	740	66
D7	1360	470	65
D10	2390	950	60
D12	1390	535	62
D15	1775	735	59
D16	3110	780	75
A11	3480	1200	66
A12	1940	930	52
A14	2630	780	70
A15	1775	760	57

J. H. Clarke: Because of the limited design information available on the subject, the Association of Iron and Steel Engineers is to be congratulated for scheduling this very fine paper on Heat Relief in Industries. It is a pleasure to be able to appear at this meeting as a guest, and to have the opportunity to comment on the paper.

As a member of the Technical Advisory Committee on Industrial Ventilation of the American Society of Heating and Ventilating Engineers, as are Mr. Small and Dr. Brandt, I am keenly interested in the subject at hand. Spot cooling is one of many studies being sponsored by our committee, and it is our hope that the new calorimeter room which was recently completed at the ASH&VE Society's laboratories may be made available in the not too distant future for extending the known information on this subject. Practically all of the research information available at present on spot cooling is the result of projects carried on for the Navy department during the last war.

Mr. Small's data on the value of radiant shields are very impressive. With proper consideration, most of us can find applications where shielding would materially improve the working conditions. For instance, in a blacksmith shop application, shields were placed around the heating-up furnaces. This not only resulted in remarkably improved working conditions, but also improved the operation of the canopy hoods over the furnaces with respect to the removal of heat and fumes. Any other means of dissipating heat in the space would have been a failure.

The question of heat shielding brings up another item which could be explored with very beneficial results. That is the matter of clothing. A tremendous amount of research has been done on this subject, (again, largely the result of projects for the armed services) and this knowledge can be applied to the problem of workers in hot industries. Properly selected clothing would increase the body heat loss by convection and evaporation and would reduce the radiant heat load to the body. Additional relief may be provided in excessively hot working areas by placing a wet towel around the shoulders, as

suggested by Dr. L. H. Newburgh of the University of Michigan. I tried wearing a wet, open weave sun hat on several occasions and found the relief to be well worth the trying. When Mr. Small's company can spin aluminum as Corning does glass or DuPont does nylon, perhaps we can solve this problem with aluminum suits.

Mr. Small's data on spot cooling are also very informative although I believe that evaporative cooling should be used with caution and only in applications for which it is best suited. The use of mancooler fans, in my opinion, should actually be discouraged because there are very few places where the ambient heat level is low enough to permit any benefit from them because they simply stir up air that is at ambient temperature. The advantage of a duct system is that it can bring the air to the worker, each worker if desired, at little increase over the outdoor temperature, (2 to 5 degree maximum) and at velocities that are of value in removing heat. While roof supply fans, discharging downwards, are better than the mancooler fans, they suffer from the lack of a duct distribution system and should be used only where it can be determined that they will be of appreciable value.

Spot cooling with outside air is very beneficial even at high ambient levels of temperature and radiation as is evidenced by the thousands of applications providing tolerable working conditions in the ships of the Navy, Army, Coast Guard and Merchant Marine. There are many other such installations giving very gratifying results ashore. It is true that there is a penalty for cooling the body by the evaporation of sweat but the dehydration effect can be, and is, counteracted to some extent, by the use of water and salt tablets. Outside air at low relative humidity and high velocity can remove about four times as much heat or more by evaporation from the skin as an evaporatively cooled system would remove by convection. Actually, if the radiation load is high or the activity considerable, the body will be in the zone of evaporative cooling in either case, and sweating will occur.

Obviously, an evaporatively cooled system will be of greater value at high radiant and high temperature conditions and will have a higher plateau of effectiveness at which it can maintain tolerable working conditions. Consequently the application of evaporatively cooled spot cooling installations in the metals industries is certainly a good one. But such systems cannot be used with success in industries where the humidity is high, such as tire molding rooms and laundries. There is also a penalty on the human organism for working in highly humid atmospheres, and even if the ratio of outside to evaporatively cooled air is kept to 20 per cent, as recommended by Mr. Small, trouble would be encountered. Also, in multi-story buildings, or single story buildings of low ceiling height and where there is a high worker population, the spot cooling air may need to be 100 per cent of the air moved through the building.

Mr. Small has mentioned some of the drawbacks to evaporative cooling. It should also be noted that the resultant high humidity will cause rusting, which is particularly undesirable where there are precision instruments or machinery in the area. One plant which I visited had so much difficulty with icicles forming in the winter from the exhaust air discharges and window condensation, as a result of the high humidity maintained in their plant, that the street in front of the building had to be roped off for the safety of pedestrians. Further, the maintenance of these systems, particularly the glass cell type, is high and this should never be overlooked when considering such systems.

There is another item to be noted with regard to evaporative cooling. Any installation of this sort will fail if it is provided on the basis of general ventilation unless the internal building load is so small that the system can actually lower the inside air temperature appreciably when the outside air temperature is at its summer maximum. This is seldom possible. Air changes and temperature rise are meaningless in working areas of high dry bulb and radiant temperature unless accompanied by adequate air movement, and the 300 fpm quoted by Mr. Small is certainly the minimum.

Mr. Small has mentioned the use of louvered outlets to obtain direction of the air to the worker. Such direction and volume control are essential, and can also be obtained by means of flexible hose, slot outlets, (provided with a slip-joint if desired to change the direction of discharge), punkah louvers (a ball with a cylindrical hole through the axis, fitted into a socket plenum), or by the Navy type "E" directional outlets. I prefer the latter in my work.

In selecting the type and size of outlets, it should be kept in mind that small nozzles and slot outlets have high induction ratios and consequently lose their effectiveness in a short distance because of decrease in velocity and increase in temperature. The advisability of large outlets is indicated by the large 15,000 cfm outlets which Mr. Small mentioned as being used for their Lafayette, Ind. remelting building. At the 2000-fpm discharge velocity quoted, this would be equivalent to 36-in. diameter outlet. The large size of the outlet was undoubtedly a great contributing factor in its success. In my own design, I usually use 12 or 14 in. directional outlets located as close as possible to the worker, or a minimum of 4 to 6 ft.

The practice of the Navy department for installations aboard their ships may be of interest. The Navy specifications require that 2000 cfm per man be provided at each operating station at velocities of 2500 to 3500 fpm, through type "E" outlets, (directional outlets with volume dampers). The outlets are required to be located 3 to 5 ft from the watchstander and to be so arranged as to make it possible to blow the air on the watchstander's torso. Laboratory tests made by the Navy at the ASH&VE laboratories indicated that the subjects did not object much or show unusual reaction to 76 and 88 F air jets at velocities of 1000 to 2000 fpm during a four hour period. At velocities of 3000 fpm and, more particularly at 5000 fpm, the subjects became very much annoyed or distressed as time passed and would step out of the air blast occasionally into the hotter air surrounding this blast.

The author has mentioned another item particularly deserving of comment and that is regarding the use of high duct velocities. High duct velocities will not only hold down temperature pick-up but will also permit a substantial savings in the cost of the installation. Good duct design in keeping with the high velocities is essential. It may be of interest to know that there are numerous high velocity supply air ventilation systems operating with complete success in offices, department

stores and industrial buildings. These velocities are as high as 4000 fpm for the office and department store buildings and as high as 6000 fpm for industrial buildings.

Whatever system or design is used, it is essential that it be designed properly for treatment *at the source of the trouble,* as indicated by Mr. Small, either by shielding, natural exhaust, (if satisfactory), mechanical exhaust, or spot cooling. The system must also be installed correctly, (including balancing and putting the system in proper working order); and must be maintained properly at all times. It would be helpful to the workmen to explain how the system is supposed to work, and to provide them with adequate operating instructions.

Bartlett R. Small: The admonition by Mr. Clarke to guard against causing high room relative humidities as a result of evaporative cooling is important. As an illustration, when motor rooms or engine rooms are shut down, the evaporative cooling should immediately be stopped, because 70 per cent relative humidity could soon develop.

But the majority of installations in heavy industry serve small areas and usually produce only one to four air changes per hour of washed air in terms of total cubical contents. In fact, with the so-called split system suggested, the ratio of raw outside air to washed air would be in the order of two or five to one, with the general humidity increase hardly perceptable when the mill is in operation.

The question is frequently raised, as Mr. Clarke suggests, whether prevailing high humidities caused by bodies of water and valleys will nullify the advantages of evaporative cooling. This would be true if the temperature in the mill is as low as that outdoors. But a condition of abnormal heat is the problem at hand and the 10 to 20 degree temperature elevation produces a 20 to 30 per cent reduction in relative humidity, so there is considerable leeway to receive moist air. In fact, one employee remarked that the moist air supply was just what was needed because of the dry heat.

Mr. Enlind points out the need of sustained reflectivity for radiation shields, realizing that fumes and the condensation of vapors with attendant dust adherence that can produce a build-up of successive layers will reduce the value of one or both faces. However, demountable sheets are easy to replace at one or two year intervals, if necessary, and the scrap value is excellent. Fortunately, common types of air borne dust deposits on a reflective sheet in vertical position have been found to generally cause only negligible harm in the infrared range of wave lengths. "The eye may be a good judge in appraising the reflectivity of a surface for visible light, but cannot evaluate the infrared radiation characteristics."(7)

Plan to Attend

1952 ANNUAL AISE CONVENTION

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IRON AND STEEL EXPOSITION

CLEVELAND PUBLIC AUDITORIUM

CLEVELAND, OHIO

SEPTEMBER 30, OCTOBER 1, 2 AND 3

ARC QUENCHING IN INDUSTRIAL CONTROL

By O. M. BUNDY
Consulting Engineer
Clark Controller Co.
Cleveland, Ohio

O. M. BUNDY

. . . . this device uses two efficient arc interrupting devices in series . . . . it combines advantages of magnetic blowouts and double break contacts . . . .

▲ WHAT are the arc quenching problems in the control industry? To one who has followed them closely, they are self-evident. On the other hand, many engineers have simply taken for granted that a contactor will interrupt any arc, and have considered a contactor as another device which must be used with a motor for satisfactory control.

A short historical background will help those not familiar with the problem to grasp the entire picture more easily. Also, it will help to answer some questions which will arise in the minds of many. A particular question it will answer is: "Why should the arc interrupting problems in control be different from those in the circuit breaker field?" The problems *are* distinctly different in present day practice and the reasons will be self-evident. Interrupting an electrical circuit, of course, has been a major problem since the inception of the industry.

In the power field, attention was given to the development of circuit breakers for occasional interruption of large power loads. The control industry was pioneered in many ways in the operation of electrical railways which mushroomed over the country around the turn of the century and required the continual switching of power.

Whether batteries or generators were used, it was always necessary to break circuits from a constant voltage bus.

The first power systems were largely direct current with little power back of them, and knife switches satisfactorily handled the job. As the power systems grew, circuit breakers were developed, first the manual type and then the automatic.

On many systems, double break circuit breakers were widely used because the laminated brush type of contact was very popular.

The group of engineers and men who lived with and solved the troubles in these early years had to be and were a progressive group of men.

There are any number of instances where something was developed ahead of its time and before it could be put to logical use.

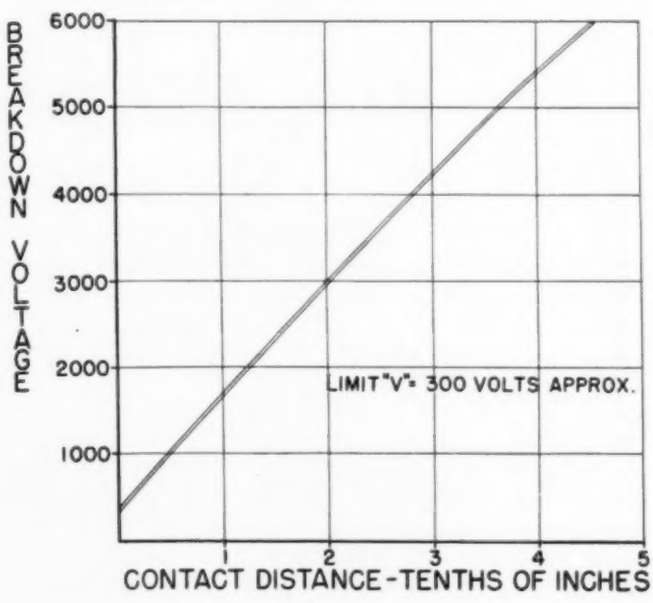
However, rather early, many basic principles were worked out, and improvements and developments were made as the industry progressed to the point where they were needed.

The author does not know who invented the magnetic blowout; however, it was used and was a new development on manual railway controllers over 50 years ago.

A few years later many of the direct current manual and magnetic starters used some sort of magnetic blowout to help extinguish the arc.

As long as 40 years ago, the main practical factors involving the interruption of arcs were known and fairly well understood. A control book published in 1917 gives a list of the factors of design on which the successful interrupting of current depended for a single break contactor. These applied in general, whether the current was alternating or direct.

Figure 1 — Even at zero contact distances, a breakdown voltage of about 300 volts is required.



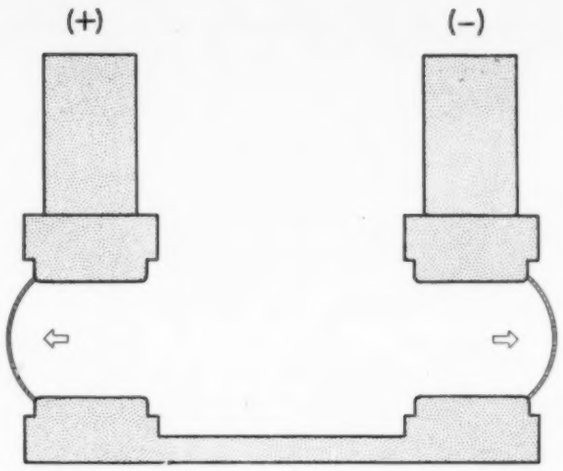


Figure 2 — Arcing on conventional double break contactor.

These factors have been regrouped into four headings which are as follows:

1. The contacts: shape, size and material.
2. The opening: separation of contacts and speed of opening.
3. Magnetic blowout, strength and distribution.
4. Arc box, design, size and material.

That list could be improved very little at the present time for any single break contactor.

In the low-voltage field, that is, 600 volts and below for both alternating and direct current, most of the equipment tended to develop along the air break line. On higher voltages it was customary to use oil switches, although these were used on low-voltage in some cases. The trend was to avoid oil immersion unless it was necessary to protect the equipment in either corrosive or explosive atmospheres.

Between 1905 and 1915, the difference between the interruption requirements of circuit breakers and contactors came to be more pronounced. The most important factors were the life expectancy of apparatus required in the two fields and the enormous increase in power system size and capacity.

This can be explained quite simply. In reviewing the list of the factors which affect the arc interrupting ability, the "separation of the contacts" and the "speed of opening" are two important ones.

In the circuit breaker field, it became necessary to have wider openings, and also to spring load the contacts so that they would open as quickly as was possible mechanically. Naturally, this put a great strain on the mechanical parts because of the forces and inertias of the parts involved.

Many circuit breakers of this type were not called upon to operate more than a few 1000 times in their life-times, so that it was possible to design a circuit breaker with a high speed of opening and yet have it strong enough for many years of service.

On the other hand, the use of contactors for electrical control was increasing. The number of operations expected of a device of control equipment changed from a few thousand up to the order of millions.

To obtain the required operational life, it was practically impossible to spring load the contacts heavily. Also, it was found that a wide opening, such as that required for circuit breakers, with the accompanying long travel of the moving parts, could not be correlated with the other design requirements. By 1920, the industry realized that to obtain the required control life, the interrupting ability of alternating current contactors in particular should be limited to approximately 10 times their rating.

On alternating current, it was found, after many tests, that a contactor could be built with satisfactory life, having an interrupting ability of 10 times its motor rating. Also, it could have a 1-second thermal capacity of 15 times its motor rating.

This thermal capacity was sufficient to prevent excess starter damage by short circuit currents, if the entire circuit were suitably protected by either fuses or circuit breakers capable of handling the system power. These considerations have been NEMA standards for alternating current for many years and are the specifications to which modern contactors are designed.

For the period from the "1920's" to the present time, alternating current contactors only will be discussed. From this period on, the nature of the requirements for these devices is divergent from direct current ones. Each is a subject in itself.

During the '20's, the majority of the contactors built were of the single break type, with blowouts being used in all cases on the 100-amp sizes and larger. Some 50-amp sizes used blowouts also. Below this value, it was found that the arc could be extinguished satisfactorily by proper arc shield design without the need of a blowout.

At the end of the '20's, the next step in this process of evolution was the re-introduction of the double break contactor for sizes of 100 amp and less.

Actually, the use of double break contacts is as old as the industry itself. Some of the first knife switches used it, and some of the first contactors used a "U" shaped stack of copper laminations which butted up against copper blocks.

All the factors which caused the abandonment of double break for a number of years cannot be mentioned. However, one was the design requirement of twice the strength of magnet while the magnets themselves were in an evolutionary state.

Also, there is considerable doubt as to whether the fact was clearly understood, at that time, that the contact opening could be shortened, using double break, without a marked decrease in arc quenching efficiency.

Up to this time, the space factor itself had not been of major importance. The use of more and more electrical control for machine tools and other applications, where a high number of devices had to be put into as small a space as feasible, began to put a premium on the space factor of the equipment in the smaller and more active sizes.

The importance of double break on small and medium size a-c contactors can be understood most easily by considering the relationship between breakdown voltage and gap length. In an a-c circuit, of course, the current in any particular phase goes through zero each half-cycle.

An attempt is always made, in the design of a contactor of this type, to prevent the re-strike of the arc following the end of the first half-cycle after the opening of the contact. This applies to all normal loads.

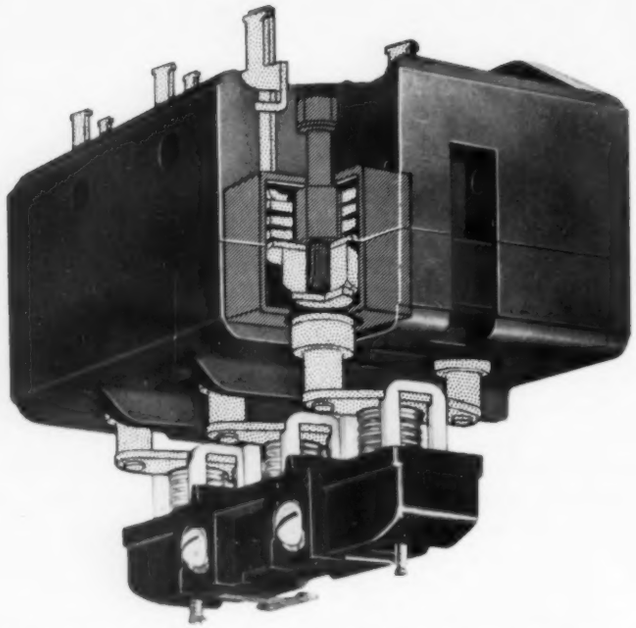


Figure 3 — Contactor construction shows blowout coil and steel arc box.

On a resistive load, this is simple, because the voltage and the current are in phase and voltage is zero when current is zero. On motor locked rotor or other reactive loads, where the power factor may be 40 per cent or less, the voltage available for re-striking the arc is practically the peak a-c voltage. This condition is common on motor controllers, and imposes the most severe conditions.

The relationship between breakdown voltage and the separation of the contacts is illustrated by Figure 1. This shows a curve which has been confirmed by several investigators showing the breakdown voltage as plotted against the contact spacing. This curve applies to flat or spherical surfaces of approximately ¾ in. in diam and larger. It was taken with cold contacts, or, that is, contacts well below ionization temperatures.

The breakdown voltage, or in our particular problem, the re-striking voltage, when plotted against contact distance, actually does not come to zero, but has a value of approximately 250 to 300 volts at zero contact separation. This curve is taken for a single break. Of course, this does not apply if the contacts actually touch, but it does mean that 250 volts are required to break down the gap even if it is only infinitesimal. The instant the current passes through zero, an insulating barrier between the contacts is established very rapidly, providing the arc has been sufficiently cooled and de-ionized.

Curves could be shown of dielectric strength recovery, re-strike voltage, and many other test curves; however, each would apply only for a specific load and operating cycle. A large number must be analyzed to present a complete picture. All of these curves would have the same general shape as shown in Figure 1, and all would tend to come to a voltage of 250 volts or higher at zero time for cool contacts. The heat of the arc, of course, does lower this value but only for micro-seconds on the usual applications.

It is evident that if a contact arrangement is amply designed, a voltage of at least 250 volts will be required to re-strike the arc, after the current has gone through zero. As mentioned before, this is for a single break, and, of course, if two breaks in series are used, this value is doubled and a minimum re-strike voltage requirement of around 500 volts is obtained.

One of the most critical operational points of an a-c contactor is a combination of a highly inductive load and the initial contact separation just before current zero. Under this condition, the difference between a re-strike voltage of 250 and 500 is readily apparent. As the separation of the contacts increase, the possibility of the voltage re-striking for double break contacts decreases rapidly as shown by the slope of the curve having voltage values approximately double those in Figure 1.

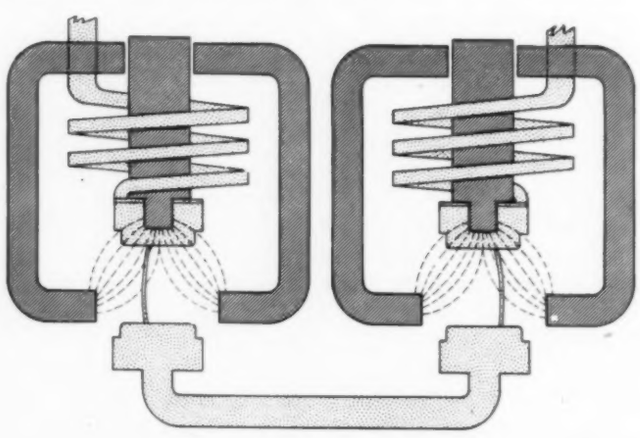
The idea of a double break, which had in general lain dormant for some years, now fitted into the picture again, because of the space requirements of the rapidly expanding industry. With respect to space, panel space alone is not the only consideration, depth is a factor. Up to this time, the conventional practice had been to use either slate or ebony panels for mounting the equipment, and all connections were made on the back of the panel.

It was found that, if equipment were designed to mount on steel in these smaller sizes, with the equipment front wired, considerable saving of space was obtained. Also, all work and maintenance could be done on the equipment from the front. This point, in particular, saved the large amount of space usually necessary to service the panel from the back.

The double break contactor fitted admirably into this type of construction and was brought out in the early '30's by several companies. One further point should be mentioned regarding the use of double break. Figure 2 shows the usual construction and the shaded current path shows that the effect of a half turn magnetic blowout is obtained. When the contacts separate, the arc, which acts similarly to a conductor carrying current, is blown to the outer edges of the contact tips. The final arcing always takes place in these particular regions of the contacts.

On smaller contactors of 25 amp and below, this is not of consequence because of the limited current and power usually available. However, on larger contactors, this arcing effect in a particular region has often resulted

Figure 4 — Contactor construction for one pole is shown.



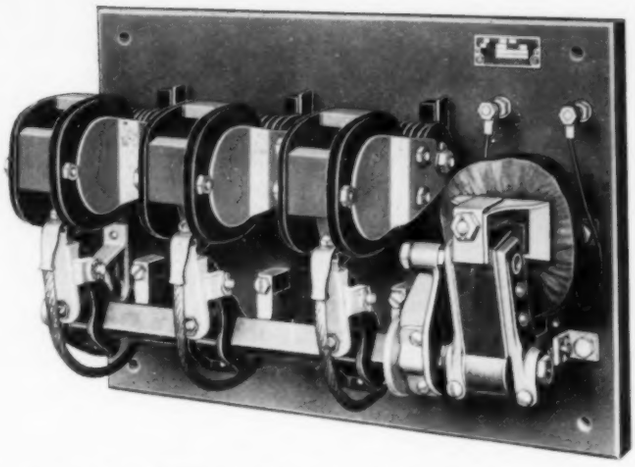


Figure 5 — Conventional magnetic blowout on a single break contactor.

in a faster deterioration of the contacts and less life than desired.

This general construction, using front wired double break equipment, has had 20 years of experience back of it, and has gradually become the accepted standard in the majority of the high production industries.

About 18 years ago, shortly after the re-introduction of the double break, the deion arc interrupting principle was introduced. This was, primarily, a circuit breaker principle, and consisted of a series of copper plates into which the arc was forced by one blowout, with a second blowout to force the arc to rotate continually within the plates.

This principle was modified, for use with small circuit breakers, by the use of steel plates and the omission of the blowout coils. It was further adapted to industrial control by putting a series of either steel or brass plates above the contact opening. A blowout coil was not used, and the half turn blowout effect of the arc circuit was relied upon to move the arc into contact with these metal plates.

Contact with the metal itself naturally cooled the arc, although this operation was not new. Forcing the arc against metal to cool it had been widely used many years before, and is still widely used at the present time.

If the first contact with the metal plate did not extinguish the arc, it was broken up into several arcs between plates and extinguished. This was a new approach to the arc interruption problem and as mentioned before, has been in use about 18 years. From the early '30's to the present, changes in control have been limited to improvements and modifications of existing principles.

The contactor construction to be described has a new arc interrupting principle which uses the magnetic blowout in a new and extremely efficient way. Furthermore, the design lends itself very readily to the double break contact arrangement which has the advantages previously described. This principle can be described as a conical field magnetic blowout. With all of the industry's past experience with magnetic blowouts and with double break contacts, it is logical, that a method using the good points of both in a rugged and compact design, is a step forward in the progress of the art of industrial control. This principle was discovered in 1942, and, during the war years, development naturally could not be carried on to any extent. At the end of the war, development was immediately started and has resulted in the present design.

Figure 3 shows the contactor construction using this principle. It has been cut away to show the construction of a stationary pole, the stationary contact and its relationship to the moving contact. The current carrying parts are shown shaded and the steel parts are cross hatched. The blowout coil is wound concentric with the center line of the stationary and moving contact. Steel parts do not carry any current.

A steel bolt, through the center of the blowout, carries magnetic flux. In addition, the steel bolt gives the contact a firm and secure support. The magnetic path is completed by a steel shell, which carries the flux from the supporting bolt around the blowout structure to a circular pole piece located below the stationary contact.

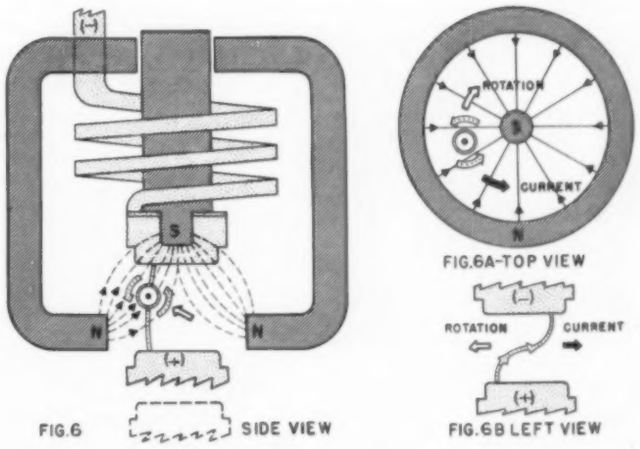
The magnetic field is established in a conical shape from the lower pole piece to the steel contact support as shown by the dotted lines in Figure 4. The complete structure for one pole is shown in this figure. Current is carried by the shaded part. Parts shown cross hatched are steel and form the magnetic circuit and the arc chambers. The magnetic flux is shown by the black dotted lines. The contacts are round, and the magnetic circuit for each pole is symmetrical around the contacts.

In actual construction, as shown diagrammatically, an air gap is introduced between the contact supporting bolt and the steel shell to insulate it from the bolt which is at full line potential.

The current path in Figure 4, starting from the top, is through the incoming conductor at the left through the blowout, and to the nut shown which carries the stationary contact. From here, the circuit is to the moving contact, through a second moving contact, and then completing the circuit through an identical arrangement.

Preliminary tests were made to explore the possibilities of this arc structure, and an intensive study of the arc mechanics of the conical field was made. This was done to determine the actual performance of the arc under all possible conditions. Also, fields of various strengths were explored with the corresponding arc performance to determine the range of usefulness of this device from a practical standpoint.

Figure 6 — Operation of an arc in magnetic field is shown in this illustration.



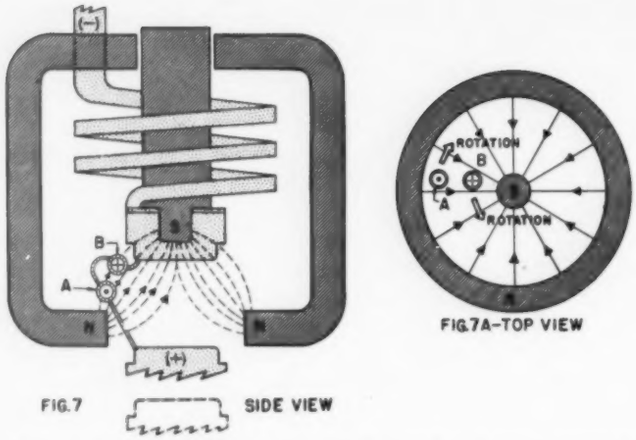


Figure 7 — Exaggerated arc path under heavy current shows arc curvature greater than that of main field.

The conclusions finally reached were that it was an excellent arrangement for use in the a-c contactor field for equipment rated from 30 up to well over 150 amp. The available testing equipment limited tests above these values.

The major design problem was the blowout itself considering the space requirements, thermal capacity, and cooling.

Figure 5 shows a conventional magnetic blowout design as used on single break contactors. The blowout coil is transverse to the contact line, and this construction allows the current density in the copper to be relatively high because of the free air circulation.

Where concentric blowouts were used, they had to be enclosed in a steel shell, and the current density in the copper had to be lower, which meant a proportionate increase in the copper size.

In a discussion of the working principles of this arc interrupting device, it could be described by dealing with either current or electrons. The simplest explanation is made possible by considering that the arc is a current in air and that current flows from positive to negative just as current is thought of conventionally.

Standard handbook nomenclature is used in describing the arc interruption. Current flows from positive (+) to negative (—) and the right-hand rule is used to determine the force on the arc. This rule says: "If the right hand is placed around the conductor (an arc in this case) with the thumb pointing in the direction of the current, the fingers point in the direction of the magnetic flux caused by the current."

In a magnetic field, the flux caused by the current in a conductor across it will add to the main field on one side and subtract on the other. The force on the conductor (arc) will be toward the weak field.

The action on the arc changes with the polarity of the contact. Thus, in an alternating current circuit, the action on a particular pair of contacts will depend on their polarities in any given one-half cycle.

Figure 6 shows a side view of the complete structure for a pair of contacts, and Figure 6A shows the top view. The general shape of the magnetic field is a cone, through which an arc must always travel.

The action of the arc in this magnetic field is most easily described by using the vetrical and horizontal components of the field flux. The vetrical component can be pictured in Figure 6, and the horizontal component is shown by the top view, Figure 6A. Refer to the section of arc bounded by the circle in Figure 6. Since current is flowing from the positive to the negative contact, the direction of the current flow will be upward. This same section of arc, with a dot to indicate current flow, is shown by the small circle in Figure 6A, the top view.

By applying the right-hand rule, the magnetic flux caused by the arc current is as shown by the dotted arrows. This flux aids the main field on the lower side and bucks it on the upper. The result is that the arc is forced to rotate clockwise as shown by the black hollow arrow.

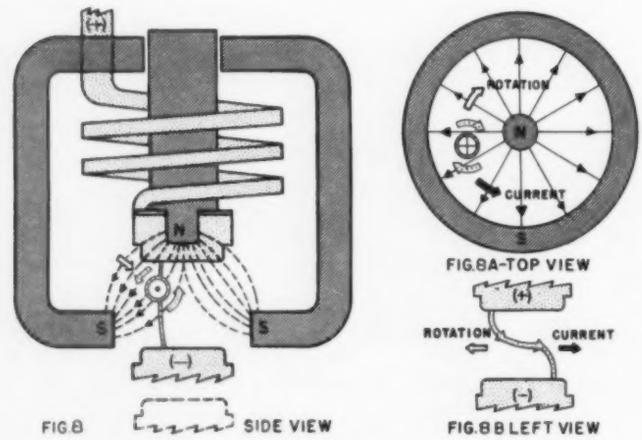
When an arc is moved by any force, the point of the arc touching the positive contact (anode) moves more easily than that touching the negative contact (cathode). This behavior appears in welding, carbon arcs, all kinds of contactors, and is sometimes called the "cathode spot" effect.

When the arc is forced to rotate clockwise, Figure 6B shows that the arc current flows in the opposite direction. Refer back to Figure 6. Here the section of arc under consideration is shown with a dot on it, to indicate the current is moving towards the viewer due to rotation. Again applying the right-hand rule, this section of arc current sets up a magnetic flux as shown by the dotted arrows. This flux aids the vertical component of the main field on the right and bucks it on the left. Therefore, this arc will be forced toward the left and to the outside portion of the contacts.

As mentioned before, the entire magnetic field is symmetrical around the contacts. As the arc strikes at random anywhere on the contacts, it must cut some part of the conical field. As it does this, it is rotated and forced to the outside portion of the contacts. The contact points of the arc must continually move from hot spots to relatively cool spots. This forced rotation rapidly cools, de-ionizes and extinguishes the arc.

A natural question is: "With a very heavy current, will this arc be blown up around the blowout coil and cause damage?" Figure 7 shows an exaggerated arc path under heavy current. The curvature of the arc shown is greater than that of the main field. The arc section marked "A" behaves exactly as the arc section described in Figure 6. However, the arc section "B" actually cuts

Figure 8 — Sketch is similar to Figure 6 except that polarity is reversed.



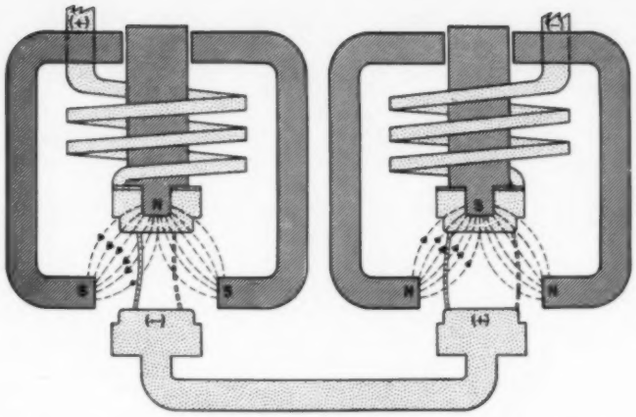


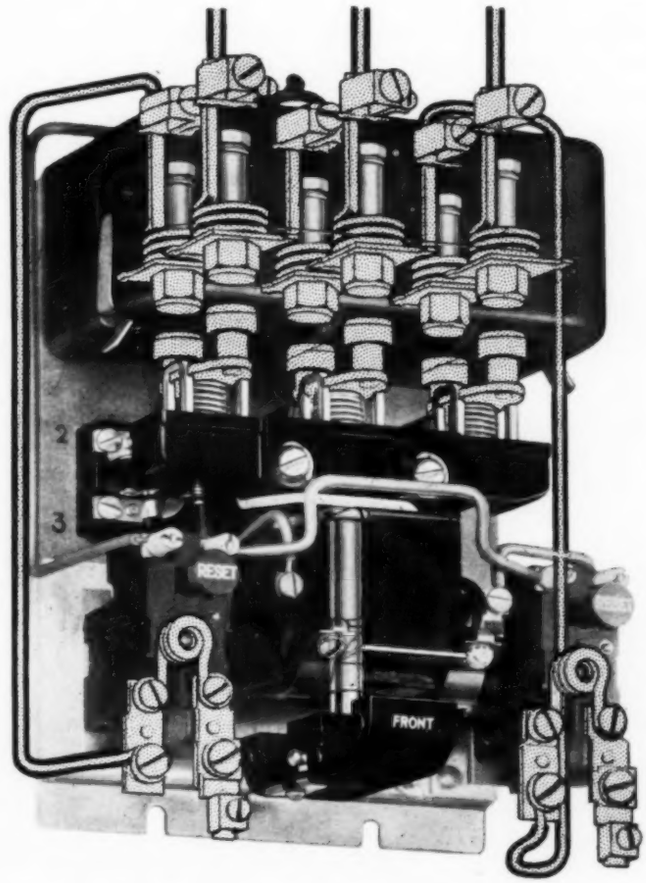
Figure 9 — Arcing is shown on double break contactor with conical field blowout.

the field in the opposite direction. The use of the right-hand rule in the top view (Figure 7A) shows that this section is forced to rotate in the opposite direction.

A heavy current will cause different parts of the arc to be forced in different directions with resultant lengthening. This quickly extinguishes the arc, and it will not be blown up around the blowout coil.

On alternating current, the conditions just described continue for only a half-cycle. Since an arc cannot be moved instantly, the arc practically never makes a complete rotation in this time. However, since the arc strikes at random, it moves to the outer portion of the contacts nearest the striking point. As a result, over a high number of operations, the arc effects are distributed completely around the outer portion of the contacts, and are not localized at any one side where the cumulative effects of the arc would cause excess burning of contacts.

Figure 10 — Illustration shows contactor with overloads.



The foregoing description covers the action of the arc when the current is flowing in what is called the negative direction through this arc structure. When the current reverses and flows in the opposite direction, a different effect occurs. Figure 8 shows the polarity reversed. The moving contact is now negative and the current is flowing in the downward direction on the diagram. This reverses the current in the magnetic blowout so that the direction of the main field flux of the main magnetic field is also reversed. The field is still conical in shape and symmetrical. The only difference is the change in direction.

Again consider the section of current bounded by the small circle in Figure 8. Figure 8A shows this current in the top view, and by applying the right-hand rule, the magnetic flux around the conductor is the reverse of that found in Figure 6A. Since the main field is reversed, the net effect is that this section of arc will rotate in a clockwise direction. Here again, the current flow is opposite to the rotation as shown by Figure 8B. Transferring this current flow back to Figure 8, the current is found as before but the main field is now reversed. The application of the right-hand rule shows that the arc will be forced to the center portion of the contact.

If an arc were a very stable sort of thing, it would be possible to force this arc into a straight line in the middle and have it stay there. Arcs just do not act that way because the heat and the electrons in the arc are continually breaking down more of the air into an ionized state. The result is that the forced rotation of the arc in the center portion of the contact cools it, and ionization is limited by the action of the magnetic field.

Figure 9 shows a complete pole with the proper polarities and the direction of magnetic fields for the polarities shown.

With the current flowing as indicated, the arc on the left pole will be rotated and forced to the center portion of the contact, and the arc on the right section will be rotated and forced to the outer portion. When the current flows in the other direction, the arc on the left section will be forced to the outer portion of the contacts, and that on the right to the center.

For any average number of operations, the arc on each pair of contacts will be broken on the outer portion of the contacts 50 per cent of the time, and on the inner portion the other 50 per cent of the time. The total effects of the arcing will be distributed over the entire contact area. The practical result of this is a very clean and smooth contact at all times, which naturally increases contact life.

Figure 10 shows a phantom view of the complete contactor and the location of all current carrying parts including the blowouts.

This new arc interrupting principle allows the use of two efficient arc interrupting devices in series. It combines the advantages of magnetic blowouts and double break contacts. It is unique in its performance, and represents a step forward in the progress of the art of industrial electrical control.

SOME DEVELOPMENTS IN OPEN HEARTH CHARGING MACHINES

By H. W. BALL
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H. W. BALL

. . . . hydraulic charging machines show promise of better operation and visibility . . . .

▲ THERE have been very few improvements made on open hearth charging machines for a number of years, they have been accepted more or less as standard design. In recent years numerous questions have arisen with regard to these machines, especially from the standpoint of safety and operator's visibility.

The writer has been of the opinion for sometime, that something should be done with these machines to overcome the difficulties that have been brought to his attention and it was decided that a hydraulic operated machine would meet the majority of these requirements. This type of machine was eventually designed by the writer, but those to whom it was suggested in the steel industry were hesitant about accepting the new design.

One steel plant purchased the conventionally designed charging machine, and after having done so, their engineers suggested that they would like to have a machine that would not be of such antiquated design. They wanted something different and a machine based on the hydraulic design was suggested to them and was accepted. They went one step more with the hydraulic operated design, by suggesting that the scrap boxes be held on the end of the peel with a clamping device together with the usual locking arrangement. This suggestion was worked out satisfactorily and accepted. However, in the process of testing the machine, the clamping arrangement was found to be adequate and the locking device was eliminated.

The clamping method prolongs the life of the peel heads as well as that of the boxes. This method prevents oscillation of the boxes during the rotation of the peel.

The machine as designed is as follows beginning with the trolley: The trolley frame is constructed of welded steel plates. This design has a better general appearance than the cast steel type frame, and it eliminates the possibility of flaws which are peculiar to castings. Every effort has been made to improve the operator's vision.

Shock absorbing equipment has been added to this trolley to prevent vibrations which tend to loosen the various parts on the trolley. The design of this shock absorbing equipment consists of two idler wheels mounted on eight springs and traveling in guides located at the after end of the trolley, and two so called kick-up wheels located directly below the idler wheels and mounted on four springs. A more recent design includes springs on the forward end of the trolley as well as on the after end. The design of the spring cushioning consists of a combination coil spring and ring spring. The coil spring absorbs the original shock and the ring spring absorbs the final shock. These springs are readily removed as a unit and have the ability to be easily maintained.

The hoist is operated hydraulically by means of two hydraulic cylinders having a bore of 4½ in. and a stroke of 19 in. These cylinders replace the conventional crank motion which had been used exclusively up to this time.

The trolley drive consists of two worm units together with motors mounted on a motor support which is independent of the trolley frame and located on either side of the trolley frame. They are directly connected to the forward track wheels through the axle. With this arrangement there are no through shafts on any part of the trolley, which in the past have often interfered with the operator's forward vision.

Provision has been made to add counterweights at the after end of the trolley for the purpose of smoother

operation. This is in addition to the shock absorbing equipment which we have already mentioned.

Hanging directly below the trolley frame and supporting the peel assembly is the peel support. This is a one-piece cast steel design. Upon this support is mounted the peel revolving drive. The drive consists of the motor and two worm units mounted at right angles to one another. A brake is mounted on the motor armature extension with the ability to add a second brake at the far end of the worm shaft directly revolving the peel. The second brake is added only if eccentric loadings are excessive. At the forward and after ends of this support are located the bearings in which the peel is suspended. It is the after bearing which absorbs the thrust on the peel.

The peel is cast in two parts and welded together forming the equivalent of a one-piece casting. Due to cost and hardship involved, a one-piece cast peel design was discarded. Over the front end of this peel there is a heat shield long enough to prevent the scuffing of the peel end and exposure to the extreme heat.

The locking device is actuated by one hydraulic cylinder having a bore of 8 in. and a stroke of 9¼ in. This is a departure from all former methods. However, we feel this to be a definite improvement. In conjunction with this clamping device there is the ability to incorporate a lock rod which automatically engages the box at the time the box is being clamped to the end of the peel. It is felt that this method will prevent any boxes from ever falling into the furnace.

The hydraulic system operating this crane consists of a single 50 hp, 850 rpm motor driving a single hydraulic pump having a volume of 60 gpm at 1700 psi pressure. Accumulators have been incorporated to prevent pressure losses and increase the speed with which the hydraulic cylinders react. The reservoir has a differential capacity of 150 gal of oil. A cam operated relief valve can be installed to prevent the operator from lifting the box when the locking rod has not located itself in the well at the head of the box. This is considered a safety measure in that it will throw the operating control to neutral unless lock rod has seated itself. He will then realize he must relocate the peel head in the box.

The hydraulic units are operated by means of two 4-way control valves located near the pump, and these in turn, are operated by two pilot operated valves. This arrangement does not require the high pressure piping to be extended into the operator's compartment.

All tubing in the hydraulic system is low carbon cold drawn seamless steel tubing, 1200 F annealed. The tube fittings are either butt welded or socket welded. The connections from the tubing on the main part of the trolley to the tubing on the peel assembly are made by high pressure flexible hose. The main hoist cylinders connected to the after-end of the peel assembly produces a rocking motion on the hoist cylinders. Therefore, a universal type mounting together with high pressure flexible hose is used. All tubing and fittings are based on 3000 psi working pressure.

The operator's compartment is designed to give maximum vision to the operator. In front of the operator there is a one-piece glass extending from top of cage to top of trolley frame and from one side of the cage to the other. This glass is ¾ in. thick. In front of this glass is located a ¼ in. splatter glass. Between this splatter glass there is a ½ in. air space. On the left and right sides of this cage extending from top of cage to top of trolley frame and from the forward end of cage to after end of cage there is ¼ in. glass. In back of the cage are located the main structural members for supporting the cage. The door is of a sliding design. In the back of the cage every effort has been made to include as much window space as possible. Located in the top of the cage there is a blower fan forcing the warm air out of the top. The air is drawn into the cage through filters located near floor line at the back of cage.

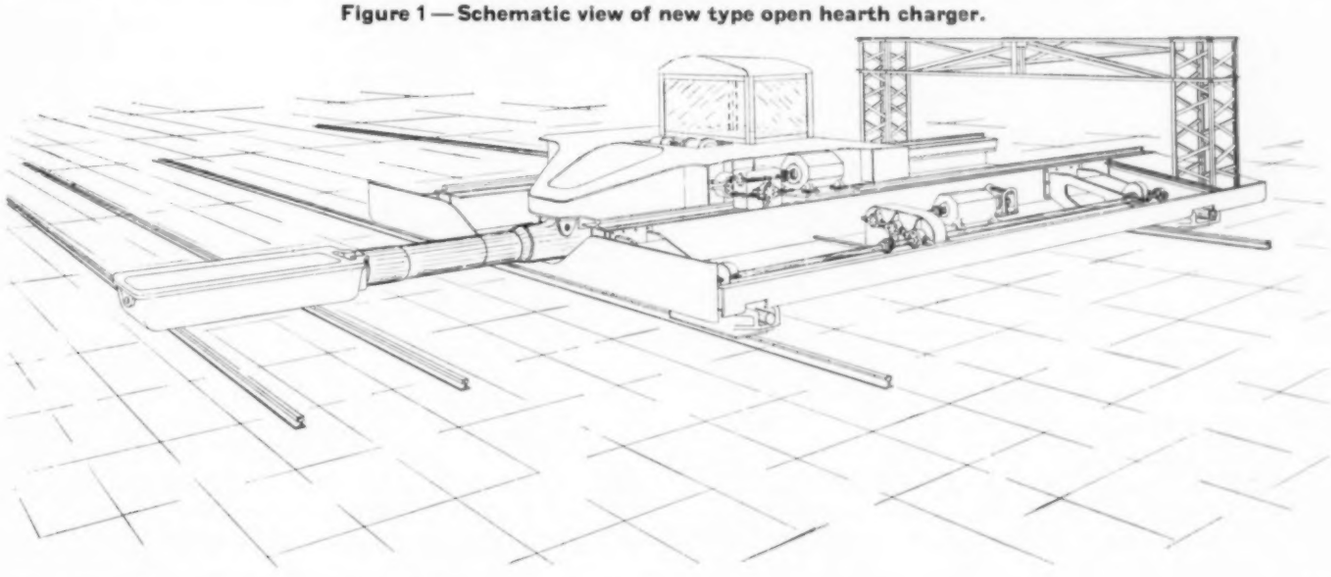
All moving parts throughout the bridge and trolley are provided with anti-friction bearings with the exception of the slide head on the peel and the bushing in the center of the peel supporting the locking rod. These bearings are modular iron bushings and are used because of the extreme temperature encountered.

The bridge is designed as follows:

All rails for both bridge and trolley are 171 lb per yard. It is the belief that on charging machines 171 lb rails should be the minimum.

Bridge track wheels are 36 in. in diam where only four are used. If trucks are used then wheels of lesser

Figure 1 — Schematic view of new type open hearth charger.



diameter will be satisfactory. Here again we believe that charging machine track wheels should never be less than 36 in. in diam when using only the four wheels. This is conducive to long wear.

The girders are of welded box section design. The advantages of this design promote lateral strength and are very helpful in pushing a drag of cars. Bridge drives have been made as low as possible. This prevents any obstruction to the operator's vision.

Track wheel gears located on the axle have been made as small as possible to prevent striking objects on the floor.

The bridge drive consists of two motors and two spur gear drives enclosed in oil tight housings, one drive on each side of bridge.

Maximum clearance has been allowed between bottom cover plate on bridge girders and the floor. Four-inch clearance has been allowed between the bottom of the end carriage and top of rail. This clearance prevents bumping materials lying on the floor.

A heavy slab has been placed across the furnace end of the bridge to prevent any damage occurring to the bridge from the scrap boxes or scrap material. In addition, shields are placed on both sides of the bridge to prevent damage from that direction.

Control boards and resistor banks have been held to the minimum height. This also aids the operator's vision.

Trolley conductors have been kept as low and as close as possible to the girders. This also aids the operator's vision.

Four take-up reels each having eight wires to each conductor and one conductor per reel are mounted on the main collector mast. The free ends of the cables are connected to the trolley. The reels allow the control boards and resistors to be mounted on the bridge. When electrical equipment is mounted on trolley, operator's vision is impaired.

Fabricated welded end carriages have been used on both ends of the bridge. It is our opinion that the welded design is superior to cast steel end carriage and this is substantiated by the fact that we have never experienced any fractures with welded end carriages.

Wearing strips have been placed on the inside below the cover plate of each girder, which gives maximum strength.

A large plate has been located between bottom cover plates of girders to assist the operator in walking away from his cab, should for any reason the trolley become stalled at furnace end of bridge.

The electrical control and equipment are as follows:

Trolley travel, peel revolving and bridge motions are equipped with full magnetic reversing plugging enclosed control panels. Trolley travel and peel revolving master switches are two point, and the bridge master is a three point. The oil pump drive motion is equipped with a safety emergency stopping device consisting of a safety cable and limit switch on each side of crane which will deenergize bridge panel and set shunt brake when either limit switch is tripped.

Figure 2 — Charger is shown in operation in open hearth shop.

Miscellaneous auxiliary electrical equipment is as follows:

Two red signal lights, one on each corner of bridge on opposite furnace end, and one motor driven signal horn mounted on cab roof with palm operated push button in operator's cab.

The design of the hydraulic charging machine has influenced the conventional type machine in the following manner. We are now using a master and slave arrangement on the lock rod which is manually operated. We also use a motor driven hydraulic pump. Two other methods are solenoid operation and motor driven.

It is the writer's opinion that on future charging machine trolleys it will be advantageous to have the after end wheels driven. This is due to the fact that materials are being crowded in the open hearth furnaces to such a height that when charging the boxes of scrap, the box tends to wedge on the top of the pile in such a manner that it forces the front of the machine upward. On the present design charging machines the front wheels are the drawing wheels, therefore, if the front

end of the machine is raised, traction is lost, causing the machine to stall in the furnace. A machine having the rear wheels driven is in the process of manufacture at the present time, and will be installed in the very near future. When this has been done we will be better able to prove our statement.

Due to the fact that the hydraulic machines were entirely new in design, there were a number of parts which have required revisions. We would like to say at this point that much credit is due to those in the field for their suggestions and assistance in overcoming many of these difficulties.

DISCUSSION

PRESENTED BY

CLARENCE ANDREWS, Master Mechanic Open Hearth, Bethlehem Steel Co., Johnstown, Pa.

H. W. BALL, Assistant Chief Engineer, The Morgan Engineering Co., Alliance, Ohio.

K. L. JOHANNSEN, Assistant Division Superintendent Maintenance and Utilities, United States Steel Co., Fairless Works, Morrisville, Pa.

H. M. MULLIN, General Maintenance Foreman, United States Steel Co., Homestead, Pa.

JOHN L. WOMACK, Design Engineer, United States Steel Co., Homestead Works, Munhall, Pa.

Clarence Andrews: I was interested in the comments on loading on the trucks. We have experienced a lot of difficulties, and we have welded our trucks. That has helped considerably. I would like to ask, on the double flange wheel, on pushing the load is there any danger of breaking the flanges on the wheel?

H. W. Ball: I think the double flange type wheels are the wheels that should be used on charging machines. But I do not think there should be a lot of play between the flanges and railhead. The closer the side clearance the better off you are. I know at one plant using single flange type wheels, on the new cranes they have purchased double flange track wheels will be furnished. The double flange track wheels will keep your wheels in better alignment than a wheel having a single flange.

Clarence Andrews: We have had difficulty in keeping them in alignment.

H. W. Ball: I think part of that is due to using light rails. I think if you use heavy rails you would not get into that trouble.

Member: In our machines, the brakes are so low that armature change necessitates two or three hours. On the new design I think it would be helpful to us if relocation of that brake were considered, perhaps the extension of the jack shaft through a coupling. I would also like to ask is what floor speed should be a maximum for a charging machine?

H. W. Ball: I will answer it in this way. There is one steel plant that wants bridge speed equal to walking speed because they do not want to injure a man on the floor. Others will have 300-400 fpm speed. With high speeds you have to watch the men on the open hearth floor. We have a safety cable on the full length of both sides of the bridge. The customer asked for it, and they are using it as their standard in their various plants. Then in case the crane hits a man coming in contact with cable, it will throw the switch, set the brakes, and the crane will come to a stop. One company will not accept over 250 fpm bridge speed.

K. L. Johannsen: Tell us a little more about that clamping device, just where does that clamp the box on the new machine?

H. W. Ball: It clamps the box—see position No. 1 of Figure 3. You can also clamp it as seen in position No. 2 of Figure 4. You can hold the box a couple of inches from the top, as seen in position No. 3.

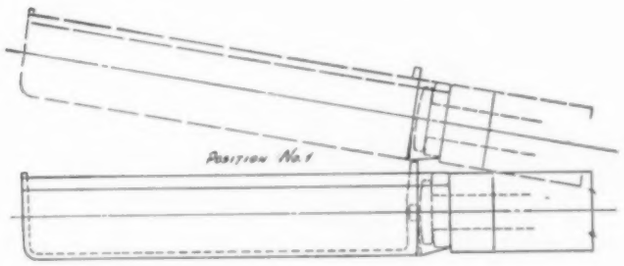
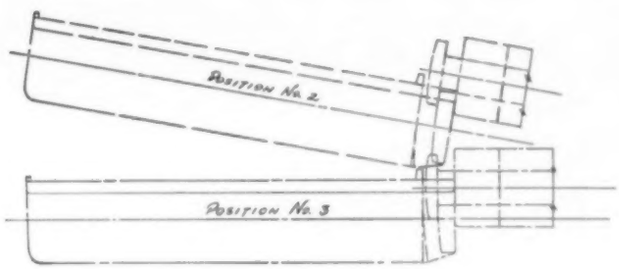


Figure 3 — Schematic sketch shows operation of clamping device.

Figure 4 — Sketch shows how box can be held in several locations.



H. M. Mullin: I know that our machines have a lot of room for improvement and I think Mr. Ball covered in his paper pretty well the things that we consider important. However, there is one point that he did not bring up, which is the peel cradle bar. It seems there is a weakness there and a fabricated section might be desirable.

H. W. Ball: The fabricated frame would be desirable. The only thing is there are so many bearings in there with the framework, that half of it would be castings. It makes it quite complicated. I do not think you will have any trouble with the new frame you are getting, after it has been redesigned.

John L. Womack: I know our original trouble on the charging bar frame was where the core slipped in this casting, it left us very little material on top, only about $\frac{5}{8}$ in., where it should be about $1\frac{1}{4}$ in. I think this new one is going to be very satisfactory, as we are getting about $1\frac{1}{2}$ in. of material at the previous breaking point.

TELESCOPIC RAM

By ROBERT W. HARRY
Vice President
Alliance Machine Co.
Alliance, Ohio

. . . . telescopic soaking pit cranes do not require high clearances, and at the same time locate the operators above the deck of the trolley . . . . the result is better visibility and operator comfort . . . .

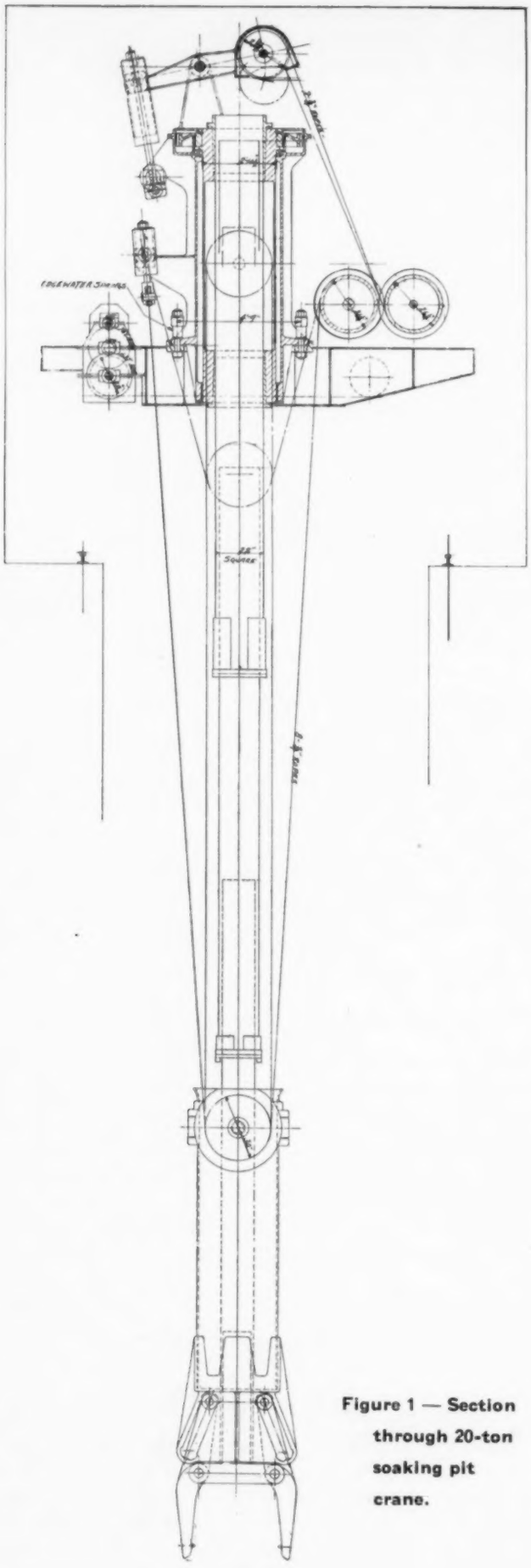


Figure 1 — Section through 20-ton soaking pit crane.

▲ OUR company builds the high rack type soaking pit crane, the conventional low type soaking pit crane with standard tongs action and with the intensified grip tongs, as well as the telescopic type soaking pit crane. All of these cranes are built either with a single range or multiple range tongs.

With the multiple range tongs, it is possible to meet the requirements of 6-in. minimum to 66-in. maximum tongs opening without impairing the intensity of the grip, or requiring greater space for installation. These tongs can be installed on any type or make of soaking pit crane.

In making comparisons with the different types of soaking pit cranes it should not be construed that this implies criticism of other manufacturers' equipment. We are rather comparing the different types of soaking pit cranes we build in our own shops. The fact that some of the types of soaking pit cranes are built by other manufacturers is coincidental and the comparisons are strictly as to type and not as to manufacture.

A few years ago we were asked to build a 10-ton standard crane. When the customer was asked where this crane was to be installed he stated that its duty was to charge and discharge ingots at the soaking pits. When asked why he did not install a regular soaking pit crane we were informed the space available and the runway were not adequate to install either the high rack type or the conventional low type pit crane. As a result of these conditions a new type soaking pit crane was developed.

This crane was equipped with a three-section, hollow, rectangular, revolving, telescopic ram. The top rectangular section, by means of four taper wedges at the top and four taper wedges at the bottom, is securely held in the sleeve that revolves when actuated by the tongs turning motor. This sleeve revolves about its vertical axis in a bracket located on the deck of the trolley. The two lower rectangular sections, of progressively smaller cross section, are raised and lowered with the tongs by means of steel hoisting ropes and the conventional motor-operated drum. Since the hoisting ropes are located outside the telescopic ram and do not revolve with the telescopic ram, it is necessary to support the lower sheave wheels on a yoke equipped with a double

PIT CRANES

ROBERT W. HARRY

ball race. These lower sheave wheels are fully enclosed to protect the hoisting ropes from the heat of the soaking pit, are located sufficiently above the tong bits so that when lifting a fallen ingot from the bottom of the soaking pit, the sheaves and hoisting ropes are well above the top of the soaking pit. The lower sheave wheels and yoke with its ball race are supported by means of a pipe welded to the top of the tong housing. This pipe is of sufficient diameter to pass over the largest section of the telescopic ram, and revolves with the ram. It also acts as a shield to prevent dirt and grit getting on the outer surfaces of the telescopic ram. To reduce the friction to a minimum between the sections of the telescopic ram when they are raised and lowered, brass bushings in the form of four brass rectangular plates, $\frac{5}{8}$-in. thick, are located at the outside top of the smaller ram sections and the inside lower sections of the larger ram sections. As wear occurs, these brass wearing plates can be shimmed to restore a good fit and can be easily replaced when necessary. We have found from actual experience that the wear of the brass wearing plates is almost negligible and a recent inspection after three to four years of operation disclosed no reason to shim the brass wearing plates. This telescopic ram is lubricated only once a week, the lubricant being applied with a brush.

The first two telescopic ram soaking pit cranes were built solely as ingot handling cranes and were specified *not* to make bottom. The telescopic ram was, therefore, designed to act only as a stiff leg guide and torque tube to transmit rotary motion to the tongs and ingot, thus enabling the crane operator to properly place the ingots in the soaking pit and to withdraw them from the soaking pit without assistance.

This type of soaking pit crane permitted the handling of ingots or slabs of any width and afforded the crane operator an unobstructed view of the tongs at all elevations as well as the ingots or slabs in the soaking pit. It also permitted the operator to be located on the deck of the trolley where he is far above the soaking pit and the hot ingot when it is raised to the highest position.

The conventional low type soaking pit crane requires a structural guide frame which depends from, and is securely bolted to, the bottom of the trolley frame. The

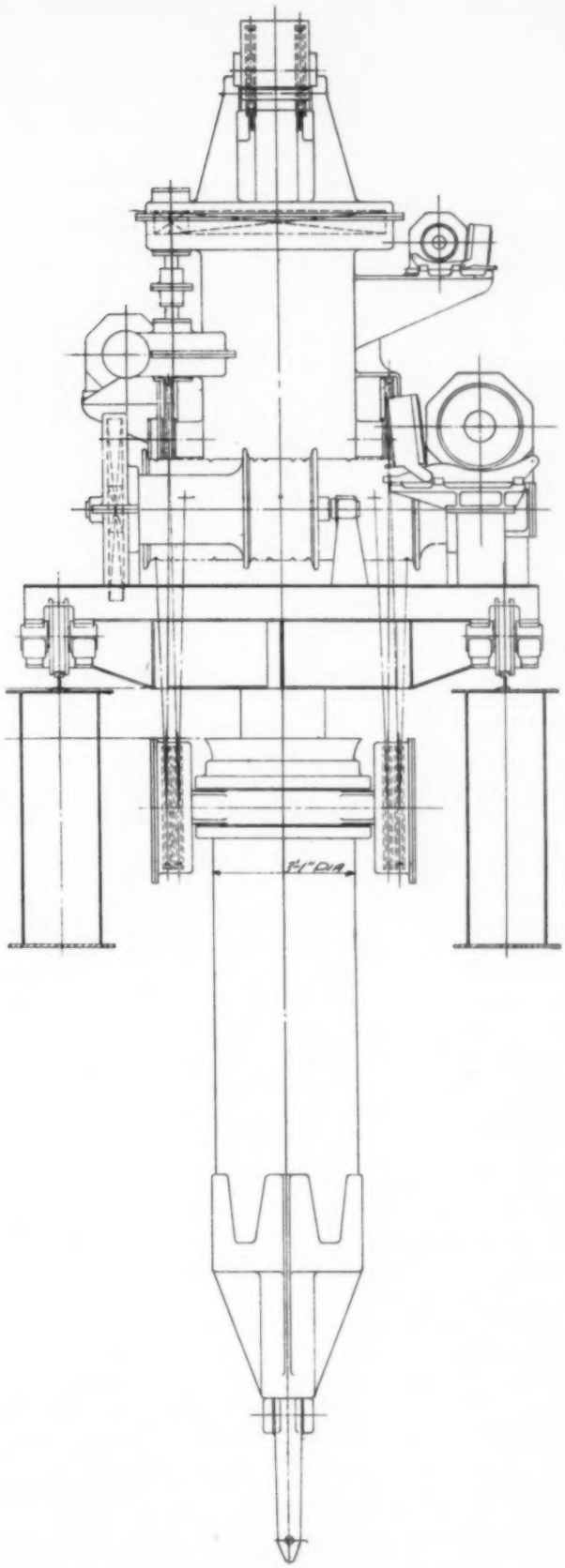


Figure 2 — Section at right angles to that shown in Figure 1.

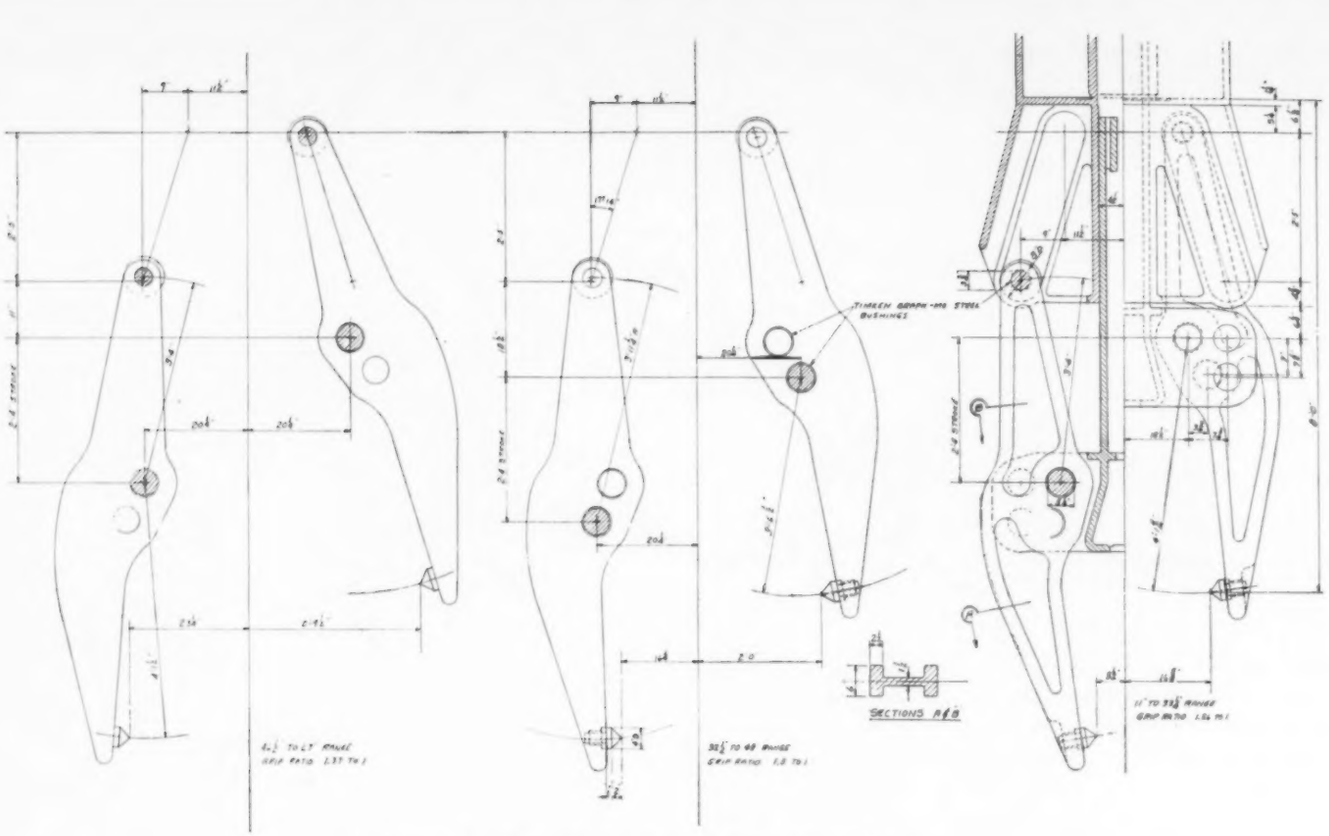


Figure 3 — Tong design for 25-ton soaking pit crane.

cross section of this guide frame is usually rectangular and must be of sufficient size to permit the tongs, handling the maximum width of ingot, to turn freely inside the guide frame. This guide frame obstructs the view of operator and prevents his being located on the deck of the trolley. In almost every case, the operator's cage is attached to the guide frame and is located below the crane girders near the bottom of the guide frame. This affords the operator a good view but subjects him to the intense heat of the soaking pits when charging and discharging ingots and when drawing a hot ingot from the pit to deliver it to the mill, the white hot ingot is hoisted inside the guide frame and is positioned only a few inches from the operator's cab. Also, when the cover is removed from one of the present-day large soaking pits to draw a heated ingot for the mill, the operator is subjected to intolerable heat which in some cases overtaxes the capacity of the largest air conditioner. It is, therefore, highly desirable to locate the operator as far above the soaking pit as possible and still give him an unobstructed view of his work.

The rack type (or high) type soaking pit crane and the telescopic soaking pit crane both give the crane operator an unobstructed view of his work when located on the deck of the trolley. The fact that the operator is located far above the top of the soaking pit has influenced many steel mill engineers in the past to install high type soaking pit cranes even though a much higher and more expensive building was required.

The telescopic soaking pit crane requires approximately the same height of building as the low type soaking pit crane and permits the craneman to operate his crane from the top of the trolley with unobstructed vision.

One of the outstanding features of the telescopic soaking pit crane is the fact that all motors, controllers, gearing and shafting, in fact all operating mechanism, is located on the deck of the trolley frame where it is accessible for inspection and ease of repair.

On account of the fact that the rectangular telescopic ram turns with the tongs it is possible to locate the driving gear at the top of the sleeve to which the top section of the ram is held in fixed position by machined taper wedges. On our 20-ton telescopic soaking pit cranes, a spur gear 60-in. diam and 6-in. face transmits the torque of a 33-hp motor to the tongs. It is, therefore, possible to make bottom of soaking pits by using a tool in the tongs and rotating it as a milling cutter by means of the 33-hp tongs revolving drive.

On the standard high and low type soaking pit cranes it is not possible to install so powerful a tongs turning drive as in both cases the "column or ram" does not revolve and the tongs turning gear must be located between the lower end of the "column or ram" and the tongs housing. A gear of large diameter at this position would interfere with the operation of the pit crane when handling ingots that have fallen over and lie on the bottom of the soaking pit and would completely obstruct the view of the operator. Even if the tongs turning gear is raised somewhat, by virtue of special design, the bearings and gearing are subjected to excessively high temperatures and excessive maintenance is the result.

At the present time we are building several telescopic ram soaking pit cranes where bottom making is specified. We have found that it is very easy to increase the sections of the rectangular telescopic ram to perform this duty.

Our telescopic rams are now designed so that they will tip the trolley off the girder rails without overstressing the ram and since this is the maximum force

that can be applied we have had no bent or broken telescopic rams to date.

We know that collisions are unavoidable in steel mills and the resulting impacts are the chief source of breakages. A collision occurring at the tongs with the "column or ram" in the low position is the main cause of ram breakages on high type soaking pit cranes and injury and breakage to the guide frame and tongs column of the conventional low type soaking pit crane. To soften the force of the impact on the telescopic ram, the bracket supporting the sleeve, to which the top section of the telescopic ram is attached and with which it turns on its vertical axis, is held down on the deck of the trolley frame by means of twenty 2¾-in. diam bolts on a 5-ft 0-in. bolt circle, each equipped with a spring. In case of collision the precompressed springs cushion the force of impact and allow the ram to assume an out-of-plumb position without jar. The springs are precompressed to give the telescopic ram the desired stability.

Since the bracket on the trolley frame which supports the telescopic ram moves when the ram is knocked out of plumb, it was necessary to locate the tongs turning mechanism on this bracket. The main hoist and the tongs opening mechanism being actuated by means of wire rope can be located on the deck of the trolley frame.

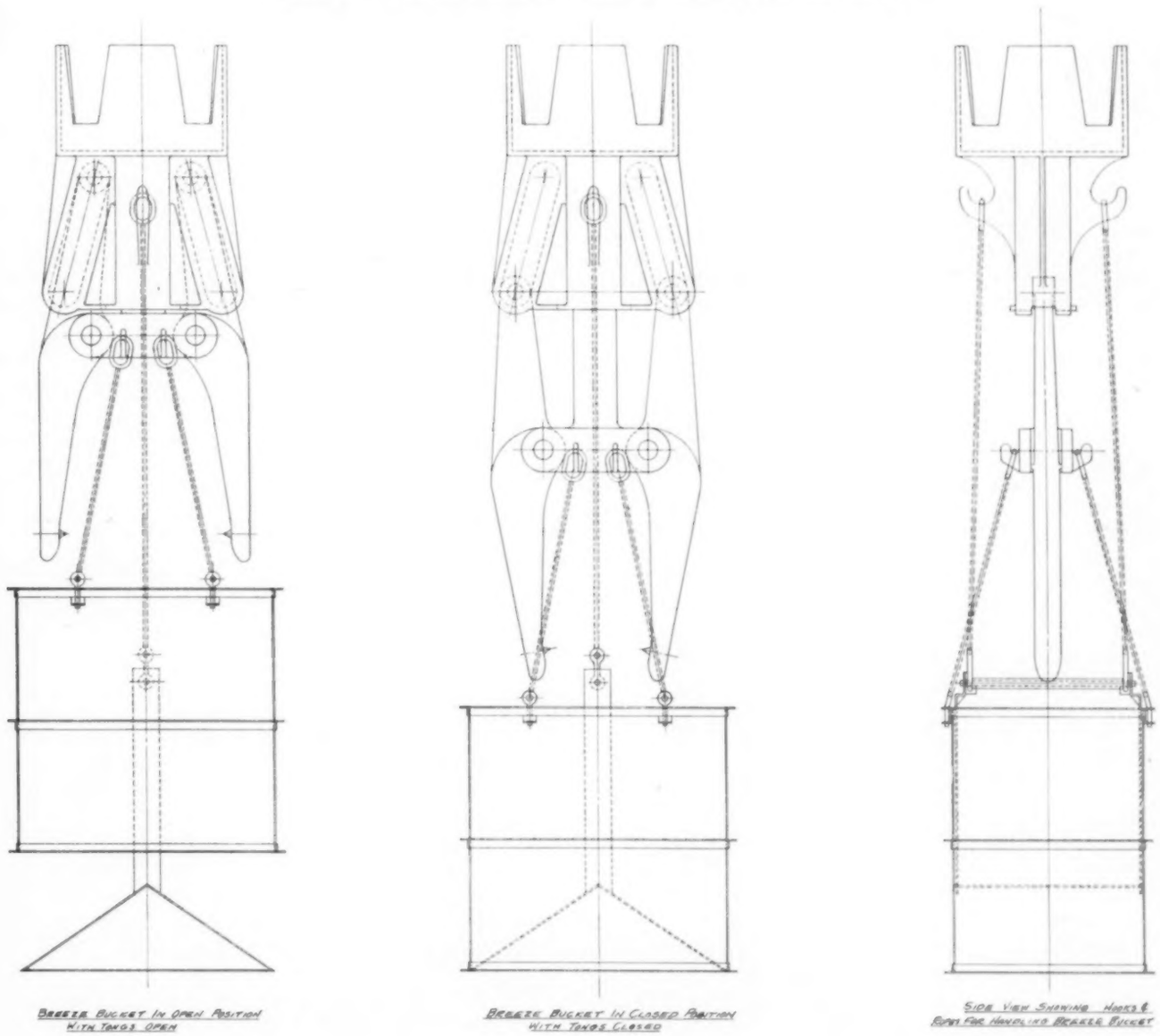
For many years we have refrained from using counterweights on soaking pit cranes as we have found from experience that counterweights are one of the chief sources of maintenance and add unnecessary weight to the crane. One of the functions of the counterweight was to prevent slack cable through the medium of a ratchet gear in the hoist mechanism. A spring-actuated limit switch located at the dead end rope equalizer effectively prevents slack cable and eliminates the necessity for the undesirable ratchet gear and counterweight.

Since the counterweight is designed to partially balance the weight of the column and tongs, it is not possible to obtain the most effective downward pressure on the tongs when making bottom.

While the majority of soaking pit cranes *are not* equipped with an auxiliary hoist, there are some that are so equipped. The chief function of the auxiliary hoist is to handle buckets of coke breeze for soaking pit bottoms.

On all of the telescopic soaking pit cranes we are now building, hooks are cast integral with the upper tong

Figure 4 — The coke breeze bucket is handled with the tongs.


Breeze Bucket in Open Position With Tongs Open
Breeze Bucket in Closed Position With Tongs Closed
Side View Showing Hooks & Rods for Handling Breeze Bucket

housing and the tong fulcrum bracket. A standard drop bottom bucket can then be used to spread the coke breeze evenly over the bottom of the soaking pit. The usual arrangement is to support the bottom of the bucket by means of chains or cables attached to the hooks that are cast integral with the upper tong housing which is welded to the bottom telescopic section. The sides of the drop bottom bucket are supported by chains or cables attached to the hooks cast integral with the fulcrum bracket.

The tong operating mechanism which opens and closes the tongs by raising and lowering the tong fulcrum bracket relative to the upper tong housing, by the same motion, raises and lowers the sides of the drop bottom bucket and regulates the flow of the coke breeze from the bucket. By this means the crane operator, working under the instructions of the heater, can control and shut off the flow of coke breeze as required.

The hooks on the upper tong housing can also be used to lift loads of any type up to the capacity of the crane. Since the telescopic soaking pit crane has no parts depending below the trolley to offer interference in handling bulky loads and since unobstructed visibility is inherent in this design, we are of the opinion that the auxiliary hoist can be dispensed with in practically every case.

We feel that the telescopic soaking pit crane has great possibilities and due to its lighter weight, greater rigidity and strength, better visibility and the location of the operator and all mechanism on or above the deck of the trolley, its maintenance and first cost should be lower.

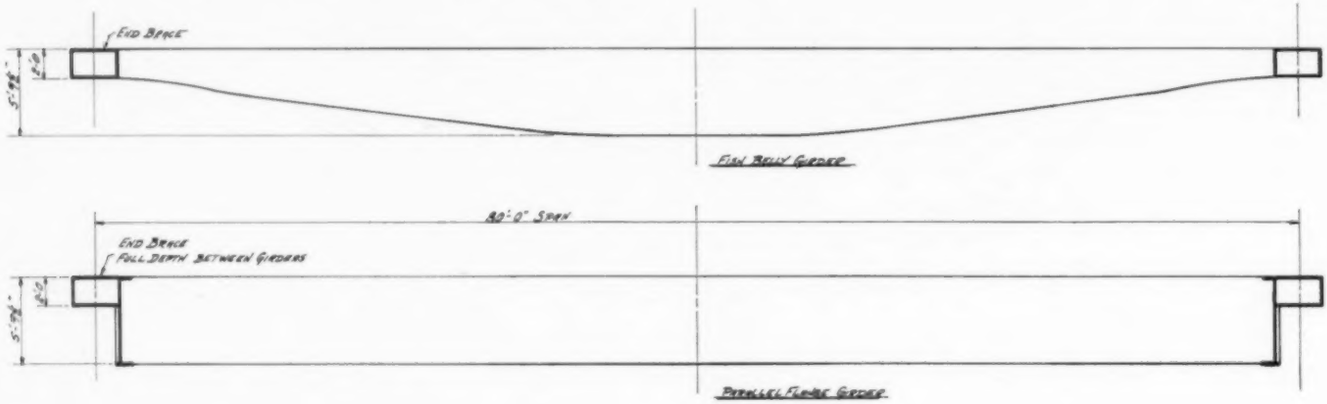
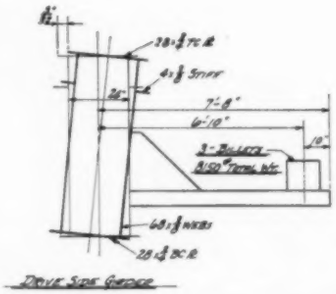


Figure 5 — Sketch shows arrangement of test using two 2450-lb billets and one 3250-lb billet to produce torsion on girder. Amount of twist of straight girder is given.



DISCUSSION

PRESENTED BY

ROBERT W. HARRY, Vice President, Alliance Machine Co., Alliance, Ohio

CHARLES J. ENLIND, Contract and Control Engineer, United States Steel Co., Pittsburgh, Pa.

JAMES FARRINGTON, Special Assistant to Chief Plant Engineer, Wheeling Steel Corp., Steubenville, Ohio

Member: I would like to ask how the cab is fastened to the crane bridge?

Robert W. Harry: On several of the telescopic cranes that we have built, the operator's cage is attached to the bottom and near the center of the crane girder. This makes a very desirable location for the operator, especially when the soaking pits are arranged in a single line or even in a double line. This permits the control equipment to be located on the footwalk and makes a more satisfactory installation for air conditioning equipment and reduces the total weight of the trolley.

Several of these soaking pit cranes with the cab fastened directly to the bottom of the girder are operating successfully in eastern steel plants.

In most cases, however, the operator is located on the deck of the trolley where he is situated as far as possible above the soaking pits and the white hot ingots, when they are raised out of the soaking pit, to be delivered to the mill.

Member: I would like to ask two questions. Mr. Harry says that the cable does not revolve with the boom. I understand that, but I wonder if lack of adequate lubrication would cause the cable to turn with the boom?

And the other is, what provision has been made to retain oil for lubrication of the telescopic action without

continual replenishing of the oil reservoir, if there is an oil reservoir on the frame?

Robert W. Harry: The first question — "Why does the turning of the tongs not wrap the hoisting ropes around the telescopic column, especially when the ball races are not sufficiently lubricated?"

In answer to this question I would say that if the ball races were absolutely neglected there would be a remote possibility of the ropes turning with the telescopic column. However, these cranes are equipped with ball races that on account of their very large size have a capacity many, many times that required for the load they are to handle. If you will refer to the sketch of the telescopic soaking pit cranes, you will find that the yoke which houses the ball race has to be large enough to fit around the pipe which supports the tongs housing. On a 20-ton soaking pit crane this pipe is approximately three feet in diameter and the pitch diameter of the ball race is 3 ft 4½ in. On account of the large pitch diameter of the ball race and the great load-carrying capacity we have never had any trouble to date with the ropes twisting around the column and do not anticipate any difficulty from this source.

I have seen many cases where cranes of 150 and 200-ton capacity were handling loads on a single hook supported on a relatively small ball race and it was possible for one man to turn this load and there was no tendency to twist the ropes at all.

We feel that the over-sized ball race installed on the telescopic soaking pit crane will very effectively prevent twisting of the ropes.

The second question was in regard to filling the pipe which supports the tongs housing with oil, thereby making it an oil reservoir which would very effectively lubricate the telescopic columns as they were raised and lowered.

This scheme was adopted on one of the first cranes of this type that was built, but it was found that when the tongs were lowered considerable oil would drip from the upper sections of the telescopic column and in case of a little wind, the oil would be blown over the floor and soaking pit mechanism, which was found to be objectionable. We find, in the case referred to that at the present time, the telescopic column is lubricated about once a week, the lubricant being applied with a brush. This has eliminated the oil drippage and solved the lubricating problem.

Charles J. Enlind: Mr. Harry, do we have to use outrigger girders on ordinary steel mill cranes?

Robert W. Harry: In answer to Mr. Enlind's question I would say that in nearly all cases the use of outrigger girders are unnecessary, where the girders are properly designed.

There are essentially two types of box-section girders used in the construction of steel mill cranes. One is known as the "fish-belly" girder whose depth in the center is much greater than the depth of the girder at the end. This type of girder was designed to save weight and to obtain uniform stress as the load is moved across the crane girders.

On account of the very small depth at the ends of the "fish-belly" girder, it was very susceptible to torsional deflection and as the cranes were built with footwalks and in many cases control equipment located on the footwalks, it was found that this torsional deflection necessitated some additional support and the outrigger girders seemed to be the only answer to that problem.

In recent years, the parallel flange girders has been more universally used and (see Figure 5) it is possible to equip this type of girder with an end brace which extends from the top flange to the bottom flange of the girder. It takes no genius to see that a girder of this type is much less susceptible to torsional deflection than the "fish-belly" type of girder.

In order to demonstrate the superiority of the parallel flange girder we arranged for a test on our erection floor. The crane selected had a span of 80 feet. After the end braces were bolted firmly into position, the footwalks were added and the bridge motor and lineshaft were installed in position. After all the equipment had been loaded on the footwalk an additional load of 8150 lb of steel billets was imposed on the footwalk at a distance of 6 ft 10 in. from the centerline of the girder and at the center of the span. With this test load, which is much greater than would be the case in actual practice, we found that the maximum torsional deflection at the center of the girder was $\frac{3}{32}$ in.

On some ladle cranes which are equipped with cabs as high as 35 ft, these cabs being loaded with control equipment, it is sometimes advisable to equip such cranes with outrigger girders to provide a better support and thereby prevent the crane cage from swaying excessively. But, even this is questionable as we have many such ladle cranes in operation without outrigger girders and the cage support seems to be entirely satisfactory.

James Farrington: In per cent of full load speed of the hoist motor, at what speed do you set the lowering motion on your crane?

Robert W. Harry: I would say that on any type of soaking pit crane you always have a good overhauling load. It is, therefore, possible, with the standard dynamic braking controller to obtain safe lowering speeds of 150 to 175 per cent of the full load hoisting speed. I would say that the maximum speed of lowering would be determined by the maximum rpm that the motor was designed for.

Member: On the coke breeze attachment, is the bin attached to the tongs and the ram used as an auxiliary hoist for opening and closing the doors?

Robert W. Harry: In regard to the operation of the coke breeze bucket, the outline drawing (Figure 4) shows three views. The view at the center shows the coke breeze bucket closed. In this position the tongs are also closed and the crosshead is in the low position. The view at the extreme left shows the crosshead has been raised by the tongs opening and closing mechanism. The raising of the crosshead raises with it the sides of the coke breeze bucket thus permitting the coke breeze to flow and spread over the bottom of the soaking pit and any time the operator wishes, he can lower the sides of the coke breeze bucket and stop the flow of the coke breeze. He can also regulate the flow of the coke breeze by raising the sides of the coke breeze bucket a small or large amount. The view on the right hand side is an elevation view and shows how the hooks are cast integral with the upper tong housing and the crosshead and to which the ropes of the coke breeze bucket are attached. This scheme is employed on many of our soaking pit cranes and is giving very successful operation.

CRANE LIMIT

. . . . constant attention to design detail and operating experience is making the crane limit switch a safer and more dependable item of equipment . . . .

▲ THE failure of a crane hoist limit switch not only causes damage to the crane itself but, all too often, it injures or takes the life of a fellow worker. Such serious consequences of a failure demands the utmost attention to fool-proof design and painstaking maintenance practices. In the past the crane design engineers would design a trolley according to standards of accepted engineering practice by using all available space for the necessary shafts, gears and motors. Then, as an afterthought it seems, they would search for a place to put the hoist limit switch. This either meant an elevated platform which left little clearance between the switch and building steelwork, or a platform on the side or end of the trolley which meant using sheaves to get the counterweight cable to a suitable location. The crane builders are now doing a good job on the present design with respect to location of hoist limits and we certainly appreciate their efforts. It is unfortunate we all cannot trade in our old cranes for new models as we do our cars.

In this discussion, I have been requested to deal with limit switch failures, which we have experienced, and also other points which we feel should be discussed further with hopes that our switches of the future will be more perfect. It would be a comfort to all of us if we could be assured of faultless limit protection at all times, and although we probably will not reach this point, we can do a lot toward improving our present units. This improvement depends not only on the manufacturers, but on each and every one of us who install, operate or maintain them.

The safety department of our corporation some years ago made a thorough study of limit switches for cranes and as a result, we are privileged to use either of the two best known units being manufactured today. This fact is certainly appreciated by all who have had the responsibility of operating cranes with either the worm type limit or an ordinary control interlock operated by a rod suspended between the hoisting cables. Recently, it was necessary to rebuild and place in service, a crane in one of our older plants, and in doing so, the last of the contactor type limits in our works was eliminated.

Despite improvements which have been made over the years to give us a reliable piece of apparatus, we still have failures which are proof that more study should be given to eliminate the remaining weak points. In addition to design, it is necessary that we continue the task of training our inspectors in the proper manner of inspecting and checking operation, and that we make sure it is done regularly. Our standard requires that limits be thoroughly inspected once each twenty-four hours by our electrical maintenance men. This inspection covers contacts, springs, connections, arc shields, counterweights, limit switch resistors and operation of tripping mechanism. Every eighteen months each limit switch is replaced and returned to our shop for complete overhaul to insure trouble-free operation. We have set a minimum size of 7 in. for any pulleys necessary to be used with the limit switches. Limit switch resistors, incidentally, should be of non-breakable, corrosion resisting construction.

In addition to the inspectors, our crane operators have a task which they must perform at the start of their turn, or as soon afterward as possible. He is required to move his trolley over some isolated section and make an actual check of limit switch operation. First, he must raise his hoist at a low speed and then by lowering the hook several feet and running it at full speed into the limit switch. He is cautioned against using limits as a part of normal operations after he makes this check.

Unfortunately for this paper, the limit switches under my jurisdiction are of one brand and therefore my comments will deal with but one design. However, there is no doubt but that similar faults can be found with our other approved type.

We have had failures of limit switches and after thoroughly checking all circuits, have been unable to definitely locate a fault. In such cases, we do not leave these switches in service, but replace them with either new or completely rebuilt units. In this discussion, I would like to deal with two failures which have been definitely located inside the switch itself.

The first failure is one which might have been prevented with a more thorough inspection by our repairmen. This was a case of breakage of the insulating material used in the arc shields and when a piece fell out, exposing the metal shield to the arc, the circuit was maintained and as a result, the hoist cable was broken. This insulating material, being very hard, could have been broken either through abuse by the repairman while inspecting or replacing contacts, or due to the fact that the arc shield itself had loosened up to the point of being struck by the moving contact when the switch was tripped. This case was thoroughly investigated and a manufacturer's representative who was called in, took the story back to the design engineers. I would like to quote from their report: "We have materially reduced the number of blowout coil turns as these were provided for 550-volt applications which are rarely encountered. By reducing the number of turns, the cross section of the copper has been increased from $\frac{1}{8}$ in. × $\frac{5}{8}$ in. to $\frac{1}{4}$ in. × $\frac{5}{8}$ in. or a 100 percent increase. The assembly has been changed so this blowout coil will be expanded and firmly hold the entire blowout assembly in place and eliminate the possibility of this wobbling on its support. This arrangement should eliminate any trouble from this score and satisfy the customer's previous criticism in this regard." I feel that all who are familiar with this switch will agree that this is a worthwhile improvement. Incidentally, since there must be either a fault in control or a master switch off center to get this failure, a thorough check was made and it turned out that we had a bad section of control cable.

The second failure occurred with the same respective contact in a later model switch. It was as follows: The shunts which connect from the moving contacts to the

SWITCH FAILURES

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terminal base have terminals which are riveted and brazed to a copper strap which fits between the contact tip and the moving contact support. This moving contact support is pinned to the contact lever support so that the contact can be placed under spring pressure. After failure, this copper strap was found to be broken and this connector fell to the stationary contact support and maintained the circuit. This was decided to be a combination of faulty assembly and design. On assembly, it should have been noticed that there was not sufficient clearance between the copper strap and the contact lever support which tended to flex the copper strap each time the switch operated. In design, this strap is somewhat of an "L" shape, and although a fillet would not have interfered in any manner, a right angle cut was made which made a sharp corner. It was at this point that the breakage occurred. A thorough check of our control wiring did not show faults so it was assumed that our operator had accidentally bumped his master switch to a hoist position while operating the second hoist.

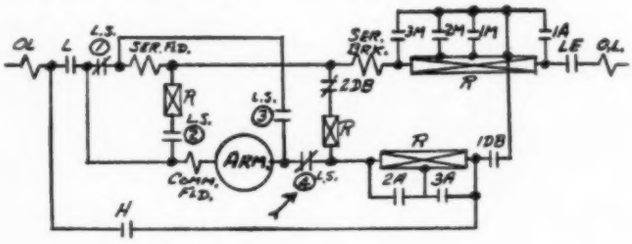
It turned out that this copper strap had been redesigned and tools were already in the process of manufacture to make them with a good radius instead of the sharp corner.

Regarding interference which gave us our flexing of the strap, I would like to quote again from the manufacturer's report: "The interference between this copper connector and the cast steel contact lever support has been taken care of by changes in the drawing to insure that proper clearance at this point will be obtained."

There is one other item which I would like to discuss at this time since it could possibly have given us a similar failure. This deals with breakage in shunts where they have been soldered or brazed into contact supports and it seemed that the shunts were crystallized. This was discussed with the factory representative and a study of working procedure found a mistake. Again I will quote from his report: "We found that the sequence of welding and plating of the connector allowed the plating liquid and fumes to attack the flexible cable, and by changing the sequence of these operations so that the welding is performed after the contact lever is plated, the flexible connector retains its fresh copper appearance and flexibility."

Such items as I have discussed readily show that many minor improvements on crane hoist limits can and will be made, thus making the steel mill a safer place to work. Crane and control manufacturers are eager to make use of the facts learned from the operating experience gained in our plants. The cooperation of the manufacturer and the customer will ultimately lead to devices that are as fool-proof as human effort can make them. If this paper brings out only one suggestion for improvement in limit switches, which will some day prevent a failure, I believe our time has been well spent.

Figure 1 — Failure of contact, indicated by arrow, to open circuit caused failures discussed in this paper.



DISCUSSION

PRESENTED BY

C. D. PARKER, Assistant General Maintenance Foreman, Homestead Works, No. 5 Open Hearth, United States Steel Co., Munhall, Pa.

C. H. LITTLEWOOD, Chief Electrician — Strip Mill, Jones & Laughlin Steel Corp., Pittsburgh, Pa.

E. L. ANDERSON, Superintendent Electrical Department, Bethlehem Steel Co., Johnstown, Pa.

J. D. O'ROARK, Assistant to Manager Service and Maintenance, Weirton Steel Co., Weirton, W. Va.

JAMES FARRINGTON, Special Assistant to Chief Plant Engineer, Wheeling Steel Corp., Steubenville, Ohio.

H. C. MULLINGS, Assistant Maintenance Superintendent, Electric Div., Jones & Laughlin Steel Corp., Pittsburgh, Pa.

C. D. Parker: We have had failures on limit switches, of course. They have been mostly due to the operators disobeying orders, and we have had a few due to failures in the limit switch. A limit switch on cranes is something that does need a lot of study, and we talk about it a lot, but I do believe that the time will come when we will have a limit switch that the operator will not be so free to use. They do use them to stop, regardless of all the training you give them, they get careless, and it is so much easier to just let the hoist go up and trust that it does not come down.

The latest type limit switches that we have are really an improvement over anything that we have had in the past, but still there is a great field for improvement. I have discussed with several manufacturers of limit switches the possibility of having a limit switch so that the operator has to reset it. I believe that is going to be the one main thing that will save lives and save damage to equipment, if the operator has to reset that limit switch every time he trips it. He is not going to run upstairs too often, because it is a hazard, and anyone that is in maintenance knows it is a problem, to have the operators continually use the limit switch. Of course good inspection is essential to good limit switch service, and that is a problem too in mills, with the speed of production and the lack of time for inspection. I think

lack of time for proper inspection is one of the reasons that limit switches fail. I do not think the limit switches would fail other than by misoperation by the operator if we have good maintenance.

C. H. Littlewood: I have had no experience with latching mechanism on limit switches but can readily see the advantages in such a unit, providing it is an electrically operated latch and will operate only when power is being applied to the hoist motor. A latch of the straight mechanical variety would mean false operations due to swinging hooks, particularly on double hoist trolleys, and would mean unnecessary delays in crane operation.

E. L. Anderson: It has been our experience that the modern type limit switch is, if properly maintained, reliable and satisfactory. Most of the troubles are caused by the type of installation, especially when operating cables are run over numerous sheaves or complicated mechanical linkage is required.

J. D. O'Roark: We agree with previous comments that the limit switch operation is put to a disadvantage due to the fact that it is usually one of the last items installed when the crane trolley is assembled. This often makes it necessary to use one or more guide sheaves for the operating weight cable which in time become fouled or interpose considerable friction in the free operation of the limit. For this reason the operating shaft of the limit switch, as well as all guide sheaves, should be equipped with sealed pre-lubricated ball bearings. We wish to comment further that we feel the manufacturers of crane limit switches have been reluctant to change any detail of the limit switch design in line with changes indicated by an accumulation of operating performance or misperformance for the sake of retaining the use of standard parts, etc. Although the sale of limit switches constitutes only a very small percentage of a manufacturer's overall control business, it nevertheless is one of the most critical and important control devices and warrants the continuous and close attention of the design engineer and manufacturing detail so as to provide the most reliable device at all times.

James Farrington: On our ladle cranes we have put on both the contactor and the screw type limit switch, using the screw type the same as is used in skip for slowdown, so when the operator hoists up the metal the screw type cuts in resistance and slows the hoist down, and the next step stops him. Should anything happen to the screw type limit switch, we follow up with the contactor that is actuated by the lifting beam. It is our intention to equip all our cranes with the screw type limit switches as far as we can possibly do so.

H. C. Mullings: Investigations of hoist limit switch failures at our plant have led us to believe that practically all failures occur when the master switch is on the first point hoisting position.

The crane operator either has not placed the master switch in the off position or has accidently knocked it to the first point hoist. Since this point is very seldom used on most of our cranes, we have recently had our master switches made so that they have to be held on either first point hoisting or lowering. We feel that this change in the master switch along with our reconditioning program of the limit switch will eliminate many failures.

SPRING END TRUCKS ON STEEL MILL CRANES

. . . . spring mounted trucks give less maintenance and reduce shock on crane, runway, and operator . . . . for some lifting positioning operations they may reduce precision . . . .

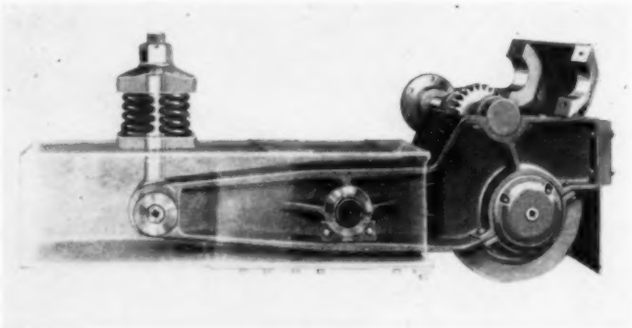
By HUGH K. HYBARGER
Chief Development Engineer
Shaw Box Crane & Hoist Div.
Manning, Maxwell & Moore, Inc.
Muskegon, Mich.

▲ THE spring end truck for cranes is an old development, which has never had the consideration by the mills that we feel it should have. It was the invention of Mr. H. E. Baker, and was patented in June, 1925, Patent No. 1,541,782. Mr. Baker, at that time, was chief engineer of our company and he developed this spring end truck to secure several advantages.

The spring end truck is illustrated in the phantom view (Figure 1), and the main features of construction are apparent. Each wheel of the crane is mounted with usual bearing cartridges in the outboard end of a hinged casting. The pivot pin is mounted in the end truck, and the reaction is taken by a nest of springs. In operation it is quite similar to the knee-action in present day automobiles, and gives the same advantages. Few, if any, would give up the advantages of knee-action on their cars, and yet it has been largely ignored on cranes.

In its application, two major advantages were anticipated. First, it would serve to cushion the crane and protect it and its associated equipment, and secondly, it would cushion the crane impact on the runway. The original idea, from gossip I have heard, was to put spring cushions under the electrical panels to protect them. This resulted in such a multiplicity of spring mounts,

Figure 1 — Action of spring mounted truck is somewhat similar to knee action in an automobile.



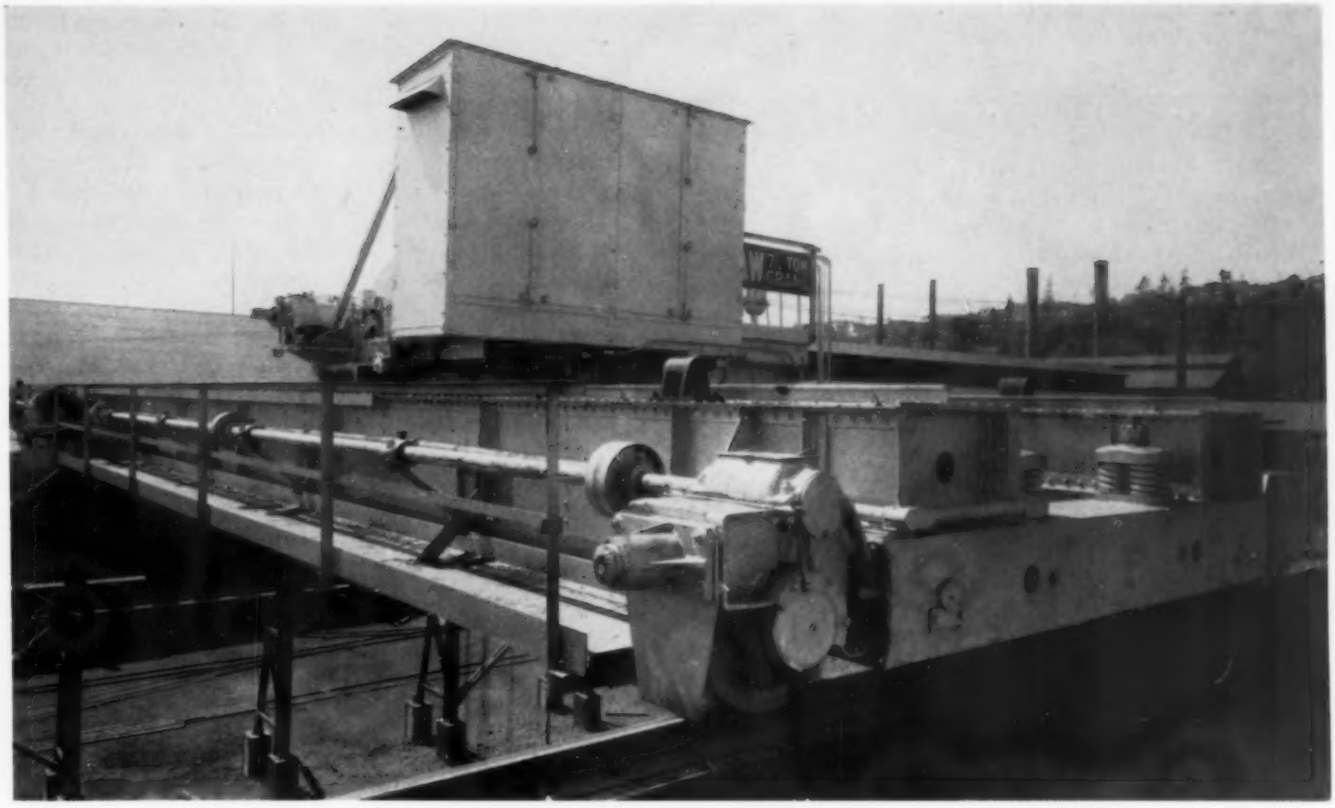


Figure 2 — This 7½-ton crane is equipped with spring mounted end trucks.

and still did not protect all the items under consideration. The inventor then conceived the idea of mounting the whole crane on springs. This protected not only the electrical equipment, but the bridge, trolley, and cage as well. Something that is of equal importance, it has an almost equally good effect of protecting the runway itself. In spite of the progress made in welding rails, most of the runways we see have splice joints, and these are rarely in best condition. With increasing crane loads, and increasing crane speeds, with increased impact on crane, runway, and building, it is time to re-examine this idea.

It must be stated that the spring end truck has never become extremely popular. However, it has been applied to cranes for some twenty five years, and the best indication of its value is the repeat orders from customers who originally purchased spring end truck cranes. It is possible that the patent itself was a deterrent to the more universal acceptance of the idea, as during its life it was necessary to purchase the spring end truck crane from our company. However, the patent expired in 1942, and since that date our competitors have been free to use this construction.

In common with all new ideas, there were a few "bugs" to be worked out. One of the first things that was found out was that the springs must be doing a great deal of work, as early installations experienced spring failures, even though apparently conservatively designed. To avoid fatigue failures it was necessary to design the springs so that the stress under full load was only about one-quarter of the elastic limit, or less. Further, the spring rate must be quite high. While this does decrease the benefits of the spring end truck, greater deflections result in an uphill condition of the girders, with a loaded trolley at one end of the bridge. However, a suitable balance can be obtained between spring rate and the weight of the bridge, so that trolley drifting can be greatly minimized. Drag brakes are the solution in case there are any remnants of drift.

Here is an idea that is twenty five years old. There have been something between 75 and 100 cranes built using it. One is illustrated in Figure 2. The best proof of its intrinsic merit is the fact that people who have had spring end truck cranes for years appear extremely anxious today to purchase more of them. There must have been some incompleteness of our sales effort, as many plants have never purchased any, but where one had been sold, they have purchased more.

So, I think, having stood the test of time, it may be a very good idea and one warranting reexamination and reapplication.

DISCUSSION

PRESENTED BY

JAMES FARRINGTON, Special Assistant to Chief Plant Engineer, Wheeling Steel Corp., Steubenville, Ohio.

HUGH K. HYBARGER, Chief Development Engineer, Shaw Box Crane & Hoist Div., Manning, Maxwell & Moore, Inc., Muskegon, Mich.

ROBERT W. HARRY, Vice President, Alliance Machine Co., Alliance, Ohio.

J. J. BOOTH, Assistant to General Superintendent, United States Steel Co., Duquesne, Pa.

JOHN L. WOMACK, Design Engineer, United States Steel Co., Homestead Works, Munhall, Pa.

H. J. KING, Mechanical Engineer, Dravo Corp., Pittsburgh, Pa.

James Farrington: I would like to ask, have you any means of checking the fatigue in those springs?

Hugh K. Hybarger: No, we do not have. However, there is a nest of four springs and due to the low spring stress and the high spring rate, it would require failure, that is, breakage of three at one time to throw the complete load over onto the fourth spring, and even under those conditions it would be sufficient to carry it. Apparently when you meet that requirement, that one spring out of the four will carry it without being overstressed, then you will not have spring failure.

Member: On the spring mounted end trucks, what provision is made to take up for the gearing in driving? If you have movement up and down, how do you keep your gearing on the pitch line?

Hugh K. Hybarger: The gearing itself at the wheel, if you have that type, is built into the truck, and your flexible couplings are between it and the lineshaft proper.

Member: All flexing then is taken up in the couplings between the lineshaft and the wheel?

Hugh K. Hybarger: That is right.

Robert W. Harry: It seems to me that it might be a good idea to design the spring end truck so that the springs would deflect sufficiently, when overloaded, to permit the truck to rest on the runway rail. This would prevent the operation of the crane and provide automatic overload protection.

Hugh K. Hybarger: Personally, I think the steel mill man would rather have the crane pick up the load and move it regardless of the consequences. So actually what you do is designed so the springs come solid before the end-truck proper drags on the rail, so no matter what the overload you can move the crane.

I agree with you if we crane builders would get together and build cranes so they would not move under excessive overload, we would be better off. Then when someone calls up and says his crane will not move, you can ask "How much overload do you have on it?"

Robert W. Harry: That would be automatic overload protection.

J. J. Booth: Spring end trucks on electric overhead traveling cranes is not a new subject to me. We were quite instrumental at Gary works of the National Tube Co. in developing the spring end truck in collaboration with Mr. Baker. We purchased two or three of these cranes as time went on and installed them in this plant and definitely found them to have advantages and disadvantages. From the standpoint of general maintenance, avoiding wear and tear on runway rails, they have their advantages. They are much easier from the standpoint of comfort to the operator operating cranes with spring end trucks. However, if you need a precision crane, such as in a machine shop where you are continually setting tools in lathes and on planers, etc, you may have a little problem from deflection depending entirely on the flexibility of the springs. Personally I thought the spring end truck crane would take better than it has, however, when you say you have only 75 out, that indicates that it has not gone over too well.

Member: I would like to ask what maximum capacity of spring end truck cranes have been installed to date, and what provision is made to inspect the springs if they are covered up?

Hugh K. Hybarger: In all the spring end truck cranes I have seen, the springs are completely out in the open. These present no inspection problem, and while springs have broken, the other three springs in the nest carry the load satisfactorily until the breakage is noticed and the spring replaced.

The largest capacity we have built using spring end trucks is 25-ton, 80-ft span.

Member: Mr. Hybarger, would you please describe how you change these springs? Also how you would change a wheel? Do you jack the crane up?

Hugh K. Hybarger: Figure 1 makes the method of changing springs apparent. Removing the cotter and slotted nut releases the tension, and the springs can be picked out and replaced readily. For changing a wheel, if you put the jack close to the wheel, bearing on the hinged casting, the wheel change is made exactly as if the springs were not there.

Member: About how much motion do you have in the spring between no load and full load? Just a couple of inches, or a fraction of an inch?

Hugh K. Hybarger: There is a couple of inches.

John L. Womack: How much vibration you would get I do not know. I would imagine on your magnet or bucket cranes, where you let the load go suddenly, you would get a rebound, and those springs would help in the rebound.

Hugh K. Hybarger: The point seems logical. However, when you consider the total weight of the crane plus load applied to the springs, and the release of the load only, the problem is much less than anticipated. With a crane weighing 100,000 pounds and 15-ton capacity, the total load is 130,000 pounds. Release of full load only reduces the spring loading from 130,000 to 100,000 pounds, and the rebound is very light. In practice it causes no difficulties.

H. J. King: I think if you confine your stresses to about 25 per cent yield point it might work, and from those installations that I have knowledge of they have not kept within that limit and consequently have had a lot of spring failures. A second point is we do have a tremendous mass in these cranes and of course the rebound would not be too great, thus having minimum effect of lifting that mass from the rails. I myself would not worry too much about rebound from this crane causing it to jump from the rails. I do think it is an advantage, with benefits to be gained. On the other hand, with delicate handling of loads it might be objectionable.

Member: How much trouble do you encounter with your couplings where you take a two-inch misalignment?

Hugh K. Hybarger: Where you have as much as two inch misalignment, using a half flex coupling at each end of a lead shaft, you have no difficulties. In effect it is the same thing as the AISE type five drive (see AISE Standard No. 6), with the lead spindle in your cross shaft proper, and the gear reduction at the wheel. That sort of thing has been worked out so well by the flexible coupling manufacturers that I think we should give them the credit and just say, it seems very satisfactory.

PROGRAM

ANNUAL SPRING CONFERENCE

SPONSORED BY

The Rolling Mill Committee

OF THE

ASSOCIATION OF IRON AND STEEL ENGINEERS

NETHERLAND PLAZA HOTEL

CINCINNATI, OHIO

APRIL 28 - 29, 1952

EDWARD T. PETERSON

Annual Spring Conference

PROGRAM

MONDAY, APRIL 28, 1952

9:00 a.m. — Registration — Fourth Floor Foyer

9:30 a.m. — Rolling Mill Session — Pavillon Caprice

Co-Chairmen:
T. M. Fairchild, Superintendent Franklin Mills
Bethlehem Steel Co.

Wade Hoffman, Superintendent Roll Department
Jones & Laughlin Steel Corp.

1. "Small Two-High Reversing Mills for Rolling of Semi-Finished Products"
   Edward T. Peterson, Vice President Engineering
   Lewis W. King, Manager, Roll Sales
   Edward C. Peterson, Engineer
   Birdsboro Steel Foundry and Machine Co.
   Reading, Pa.
2. "Increasing the Productivity of Fontana Blooming Mill"
   William A. Vogt, Project Engineer
   Kaiser Engineers, Inc.
   Oakland, Calif.
3. "Factors Which Influence the Surface Quality of High Sulphur Steel"
   George G. Blean, Steel Works Metallurgist
   Jones & Laughlin Steel Corp.
   Pittsburgh, Pa.

WILLIAM A. VOGT

9:30 a.m. — Electrical Session — Parlors A–B–C–D

Co-Chairmen:
James D. O'Roark
Weirton Steel Co.

Roland Hess
Armco Steel Corp.

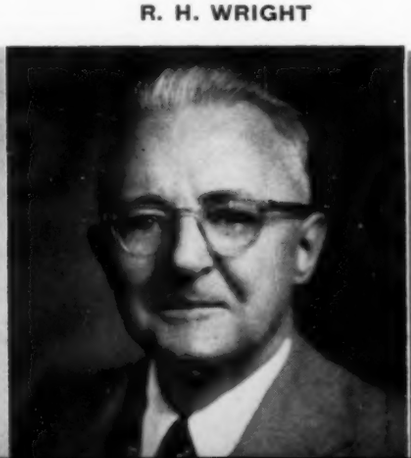
1. "Inertia Studies for Modern Mill Drives"
   J. F. Sellers, Engineer-in-Charge, D-C Motor & Generator Design
   T. B. Montgomery, Engineer-in-Charge, Control Design
   Allis-Chalmers Manufacturing Co.
   Milwaukee, Wisc.
2. "Application and Control of A-C Motors for Intermittent Loads"
   R. H. Wright
   Westinghouse Electric Corp.
   East Pittsburgh, Pa.
3. "Selection and Analysis of Regulating Systems for Mill Drives"
   W. E. Miller
   and
   F. S. Rothe
   General Electric Co.
   Schenectady, N. Y.

GEORGE G. BLEAN

J. F. SELLERS

T. B. MONTGOMERY

R. H. WRIGHT



W. E. MILLER

LEWIS W. KING

EDWARD C. PETERSON

CHAS. C. HILL, JR.

HARRY GILCHRIST

2:00 p.m. — Rolling Mill Session — Pavillon Caprice

Co-Chairmen:
Alex Montgomery, Jr.
United States Steel Co.

Louis Moses
Bethlehem Steel Co.

1. "Identification Marking of Blooms, Billets, and Slabs"
   Charles C. Hill, Jr., Assistant to Chairman Rolling Mill Committee
   United States Steel Co., Pittsburgh, Pa.
2. "Operation and Roll Design of the Gary Rail Mill"
   R. W. Dickson, Division Superintendent, Central Mills
   United States Steel Co., Gary, Ind.
3. "Pass Design for Hexagons"
   H. E. Muller, Assistant Superintendent, Roll Department
   Inland Steel Co., Indiana Harbor, Ind.

H. F. JACQUART

2:00 p.m. — Mechanical Session — Parlors A–B–C–D

Co-Chairmen:
Emil Kern
Allegheny Ludlum Steel Corp.

J. B. Whitlock
Armco Steel Corp.

1. "Various Applications for Composition Non-Metallic Bearings"
   Harry Gilchrist, Lubrication Engineer
   K. W. Atwater Engineering, Inc., Pittsburgh, Pa.
2. "New Installations and Developments for Increased Capacity"
   G. D. Tranter, Manager, Middletown Division
   Armco Steel Corp., Middletown, Ohio
3. "Planned Maintenance of Blooming Mills"
   H. F. Jacquart, Master Mechanic, Blooming Mills
   Jones & Laughlin Steel Corp., Pittsburgh, Pa.

G. D. TRANTER

7:00 p.m. — Informal Dinner — Hall of Mirrors (3rd Floor)
An address by W. W. Sebald, President
Armco Steel Corp.

(Program continued on next page)

R. W. DICKSON

F. S. ROTHE

H. E. MULLER

W. W. SEBALD

H. H. WARNOCK

J. L. HOLMQUIST

J. L. WHITTEN

TUESDAY, APRIL 29, 1952

9:00 a.m. — Rolling Mill Session — Pavillon Caprice

Co-Chairmen:
D. W. Lloyd
Youngstown Sheet and Tube Co.

J. N. Imel
Jones & Laughlin Steel Corp.

1. "Accident Control in Rolling Mills"
   Carter Kendall, Chief Safety Engineer
   Bethlehem Steel Co.
   Bethlehem, Pa.
2. "Design and Operation of a Four-Stand Semi-Continuous Hot Strip Mill"
   H. H. Warnock, Superintendent Strip and Bar Mills
   Youngstown District
   Republic Steel Corp.
   Youngstown, Ohio
3. "Investigation of Material Displacement in Mannesmann Piercing by Means of Model Wax Billets"
   J. L. Holmquist, Director of Research
   Spang Chalfant Division
   National Supply Co.
   Ambridge, Pa.

9:00 a.m. — Combustion Session — Parlors A–B–C–D

Co-Chairmen:
E. T. W. Bailey
Steel Co. of Canada, Ltd.

George H. Krapf
United States Steel Co.

1. "Single Stack High Convection Annealing for Narrow Steel Strip"
   J. L. Whitten, Vice President
   Lee Wilson Engineering Co., Inc.
   Cleveland, Ohio
2. "Steel Defects Commonly Attributed to Heating"
   George Y. Boal, Supervisor of Metallurgical Control
   Crucible Steel Co. of America
   Midland, Pa.
3. "Automatic Controls for Regenerative Soaking Pits"
   Griffin L. Isaacs, Assistant to Superintendent of Blooming Mills
   United States Steel Co.
   Duquesne Works
   Duquesne, Pa.

1:00 p.m. — INSPECTION TRIP —
Armco Steel Corp., Middletown, Ohio

Trip must be made on authorized buses which will leave from Netherland Plaza Hotel.

GEORGE Y. BOAL

GRIFFIN L. ISAACS

CARTER KENDALL

HOTEL RESERVATIONS

Hotel reservations should be made direct to Manager of Reservations, Netherland Plaza Hotel, Cincinnati 1, Ohio, giving time of arrival and type of accommodations desired. Reservations should state that they are for AISE Spring Conference.

ABSTRACTS OF TECHNICAL PAPERS

FOR

Annual Spring Conference

April 28 - 29, 1952

Cincinnati, Ohio

SMALL TWO-HIGH REVERSING MILLS FOR ROLLING OF SEMI-FINISHED PRODUCTS

By EDWARD T. PETERSON
Vice President Engineering
LEWIS W. KING
Manager, Roll Sales
and
EDWARD C. PETERSON
Engineer
Birdsboro Steel Foundry and Machine Co.
Reading, Pa.

▲ THE general field of 2-high reversing mills for the production of semi-finished products are reviewed, and recent trends discussed. The special place of the small reversing mill in this picture is also pointed out.

Means used by the specialty steel producers for producing semi-finished products are next to be examined. In addition, installations of reversing mills under 30-in. diam previous to 1938 are reviewed briefly, followed by a more detailed discussion of recent installations in this size group. A few mechanical features recently developed on small reversing mills are also discussed.

The use of the small reversing mill for producing semi-finished products, in comparison with the use of 3-high mills of various types, as well as the forging process are examined, and comparative cost figures are offered.

FACTORS WHICH INFLUENCE THE SURFACE QUALITY OF HIGH SULPHUR STEEL

By GEORGE G. BLEAN
Steel Works Metallurgist
Jones & Laughlin Steel Corp.
Pittsburgh, Pa.

▲ THIS paper discusses the operating and metallurgical factors relating to the handling and rolling of high sulphur ingots. The effectiveness of mold coatings in reducing imperfections on the surface of ingots and thereby improving the billet quality is shown. The desirability of pouring these steels into round rather than square molds is discussed. In handling, the prompt delivery of ingots to the soaking pits, and from the soaking pits to the blooming mill, is emphasized.

Proper pit time/track time ratios are shown to be necessary to help maintain the highest level of surface quality. In discussing the blooming operations, emphasis is placed upon light initial drafts with ingots heated to finish at 2100 F or above. The effectiveness of saddening on the billet quality of the more sensitive grades is illustrated. Hot scarfing or desurfacing is discussed and some results showing the effectiveness of this practice are shown. In rerolling the billets to bar products, it is stated that little difficulty is encountered as the red shortness characteristics appear to be more troublesome in the cast structure.

INCREASING THE PRODUCTIVITY OF FONTANA BLOOMING MILL

By WILLIAM A. VOGT
Project Engineer
Kaiser Engineers, Inc.
Oakland, Calif.

▲ THE Fontana plant of the Kaiser Steel Corp. has now been operating for ten years. The plant was built during World War II with the main purpose of producing plates for ship building.

Due to war economics, all kinds of restrictions were placed on the construction of the plant. The severest one was the order to use an absolute minimum of heavy equipment.

Complying with these restrictions, the Fontana layout did not include a heavy blooming mill for slabbing of plate ingots, but provided for direct rolling of plates from bottom-poured ingots.

When, a few months later, the WPB authorized rolling mill additions for the rolling of structural shapes, again no blooming mill was included. The plant additions consisted of a 36-in. break-down mill and a 29-in. structural mill. Space was left between the soaking pits and the 36-in. mill for a future blooming mill which, however, has never been built. The gap between soaking pits and 36-in. mill is over-bridged by an ingot transfer car.

Since the start of operations, the Fontana production has increased from 500,000 tons per year to more than 1,200,000 tons per year. Whereas this increase in pro-

duction was made possible by added facilities in the iron and steel division, no additions to primary rolling facilities have been made to handle the increased rolling mill production. This is the more remarkable as a switch from direct rolling of plates to slabbing of ingots has placed the total production load on the 36-in. mill.

It is the purpose of this paper to describe how the 36-in. mill was modified to take the unusually high production load, how the roll lift was increased to allow for wider slabs, and how it was possible to use in the modified arrangement the existing rolls, spindles and pinions by simply raising the pinion housing and the drive motor by a few inches, all well within the permissible angularity of the spindles.

The additional facilities which became necessary in connection with the adoption of slabbing of ingots, conditioning and reheating of slabs, are described.

The overall economical advantages arising from the changes compared with the original arrangement and practice, are discussed and illustrated by tabulations and arrangement drawings.

APPLICATION AND CONTROL OF A-C MOTORS FOR INTERMITTENT LOADS

By R. H. WRIGHT
Westinghouse Electric Corp.
East Pittsburgh, Pa.

▲ CHANGING conditions in the steel industry have shifted the angle of approach to the problem of applying equipment for intermittent rolling mill loads. Improved design of synchronous motors and the increasing capacity of power systems have made it possible to eliminate flywheels for many applications. Synchronous motors may be used either for direct drive on certain constant speed applications or they may be used to drive generators for supplying adjustable speed or reversing drives. Before selecting a synchronous motor for either type of application, it is desirable to determine how the inherent characteristics of a synchronous machine will affect the power system.

If load is applied to a synchronous motor gradually, the input from the line will also rise gradually with no transient variations. If the load is applied suddenly, the rotor will oscillate and the line input will fluctuate rapidly and violently until the oscillations are damped out. Similar mechanical and electrical oscillations occur when load is released suddenly. On short mill passes, oscillation will be continuous throughout the pass and for some time after. When a synchronous motor-generator supplies a reversing drive, reverse power peaks are also reflected to the a-c line. Field tests show that the total variations of a-c power can easily be four or five hundred per cent for normal reversing mill loads. A number of drives are in successful operation in favorable locations under such conditions. Power system limitations will probably make it desirable to use induction motors and flywheels for some applications and some locations for some time to come.

The liquid slip regulator provides the best means for controlling the input for applications requiring an induction motor and flywheel. The average speed of the system is higher and the slip losses are lower than for a fixed slip resistance. The only serious objection to the slip regulator has been its bulk. A completely new design has been developed to overcome the limitations of the older types. This regulator has forced circulation of the electrolyte and a separate stainless steel heat exchanger. The electrical system is housed in a separate control cabinet and is actuated from a standard current transformer. The setting is adjusted by means of a small rheostat.

SELECTION AND ANALYSIS OF REGULATING SYSTEMS FOR MILL DRIVES

By W. E. MILLER
and
F. S. ROTHE
General Electric Co.
Schenectady, N. Y.

▲ THE outstanding production records being made today in the steel industry are to a very considerable extent the result of improvements in the art of regulating system design. Much has been reported in the popular press of the computing machines, mechanical analyzers, and electronic brains that have made possible the almost uncanny accuracy of the gunfire control systems used on today's bombers, and warships. While there is a world of difference in the size and weight of aircraft and steel mill equipment, the mathemetics expressing the performance of the two are similar. All the modern calculating tools available are being utilized to bring forth the utmost in performance on both types of equipment.

However, more is required than just a knowledge of mathematics and differential equations. A successful application of regulating equipment involves a thorough understanding of the process involved and an appreciation of the factors affecting product quality as well as tonnage. The first and most important step in the application of regulating systems is to select the right type of system for the job. There are four fundamental quantities in electrical systems that can be regulated—position, speed, voltage, and current. The place of each in steel mill systems, and the factors involved in the selection, are discussed.

A decision must be made as to the accuracy, speed of response, and system damping required by the process. A choice must be made as to type of regulating equipment. Today we have contactor systems, amplidynes, amplistats, electronic amplifiers and sensing devices, and combinations of these basic forms. Experience with all types and a knowledge of the performance characteristics of each are essential to make the proper selection.

A preliminary analysis is required to determine the approximate rating and order of magnitude of the constants of the components of the system. Studies are then made using one or several of the available analyzers to determine the exact effect of changes in component characteristics, ratings and system circuits upon over-all performance. The various analyzers are described and the results of studies on 6000 and 7000 fpm cold strip mills and other types of equipment are shown and compared with test data.

The immediate successful operation and the record breaking production of Jones and Laughlin's 6000-fpm cold strip mill, as well as the acceptance by the steel industry of that first individual generator regulating

system as its standard for high-production cold mills, demonstrate well that regulating systems can be engineered to solve the production problems of the steel industry.

OPERATION AND ROLL DESIGN OF THE GARY RAIL MILL

By R. W. DICKSON
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Gary, Ind.

▲ THE use of an edging pass in dummy stand, the application of head and base wheels in leader and finisher stands, respectively, and the wide range of products currently produced on the Gary rail mill, which rolled a record tonnage in 1951, are reviewed. The Gary rail mill was first placed in operation in February, 1909. The mill is the cross-country type, and numerous improvements over the course of the 42 years it has been in operation have kept it highly competitive. The mill consists of five 40-in. stands containing 9 passes and seven 28-in. stands containing 9 passes. It is one of the three rail mills in the United States which roll rails direct from ingots without intermediate reheating. Ingots 24 × 24 in. are rolled in only 18 passes to any of 23 railroad sections from 60 to 133 lb per yard. This same ingot size also is reduced in the same number of passes to any one of three crane rail sections of 105, 135 and 175 lb per yd weights.

The use of a tongue and groove style of rolling, which differs materially from the conventional rolling in the dummy pass, and the use of roller bearing head wheel in the leader and roller bearing base wheel in the finisher, produces rails of extremely close tolerances in relation to section templates, freedom from objectionable center base seams and flat base.

An intensive development program to make the mill competitive in the rolling of products other than rails has resulted in the installation of many additional facilities, including modern automatic soaking pits for heating ingots supplied to the mill, billet shear and transfer bed for slabs and billets rolled from 24 × 24 in. and 23 × 23 in. ingots in only 11 passes, hot deseaming unit, heavier pinion housing for former stand, temperature recorders, and mechanical twisters throughout the mill. Products currently being produced on this mill in addition to rails are billets, slabs, rounds and die-rolled crankshaft billets.

A unique schedule permits maximum use of down periods for roll changes so that roll change delays involve less than five per cent of the operating time, even when operating the mill 18 turns per week. The mill has a slow cooling capacity of over 9000 tons and is capable of slow cooling all products rolled on the mill if so required.

PASS DESIGN FOR HEXAGONS

By H. E. MULLER
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▲ THE relative importance of the hexagon as a bar mill product is briefly reviewed in addition to the applications to ultimate consumer items. Requirements of the trade with respect to quality is mentioned.

A general discussion of the principal rolling methods is followed by a detailed description of the layout of leader passes for sequential sizes within the mill range.

The number and type of forming passes preceding the leader pass as well as the reasons for differences in forming methods is outlined. A number of graphical representations illustrate variations in the design proportions of passes as functions of bar size and method of rolling.

Typical bar mills are illustrated with corresponding pass layouts. The relationship of roll design to mill peculiarities is discussed.

The potential production possibilities of the hexagon product is taken up and compared with the production rate of rounds on several mills. Factors which may alter or modify production rate are related to the pass design.

NEW INSTALLATIONS AND DEVELOPMENTS FOR INCREASED CAPACITY

By G. D. TRANTER
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Middletown, Ohio

▲ THE steel industry has made remarkable strides in production, quality and efficiency, particularly during the past decade, to meet the unprecedented demand for steel products. In addition to the modernization of existing equipment, new steel producing facilities have been rapidly engineered, constructed and put into operation in an unbelievably short space of time.

The subject matter of this paper is a description of the new installations and developments, during the postwar period, at the Middletown division of the Armco Steel Corp. The program is typical of the many expansion and development projects throughout the industry.

The new facilities include two continuous zinc coating units based on the sendzimir process, two electric furnaces tapping 105 tons per heat, three 250-ton open hearth furnaces using an entirely new arrangement for delivery of charging buggies to the charging floor, and a new blast furnace plant, now under construction, consisting of one 1450-ton furnace and 76 coke ovens.

The hot strip mill capacity has been increased by adding new soaking pits, a new slab furnace and certain mechanical improvements. Heavier housings, larger rolls, and new chutes and loopers were installed in the finishing train. The program also included larger screwdowns and motors, replacement of a coiler with one of heavier design, and the revamping of mill tables and other equipment where the need for more rugged construction was indicated.

Processing and finishing facilities have been increased and will be further augmented when additional ingot tonnage is made available through the use of more hot metal from the new blast furnace.

The new processing equipment will consist of annealing furnaces, a coil temper mill, cut up shears, and increased storage space for in-process material.

The new installations and developments described in this paper will further improve the efficiency of operations and provide well balanced steel melting, rolling and finishing capacities.

PLANNED MAINTENANCE OF BLOOMING MILLS

By H. F. JACQUART
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Jones & Laughlin Steel Corp.
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▲ MAINTENANCE at the present time may be the difference between ordinary and superlative performance, and in a highly competitive field may be the difference between survival and failure. Best results in achieving good planned maintenance are obtained when supervision considers its problems as special, and plans its program accordingly. In an industry such as steelmaking where continuous operations are present, the most costly part of a breakdown is not the actual repair but the inconvenience suffered because of a breaking down of the production operation.

Some of the most important factors to be considered in achieving planned maintenance are the following:

1. Physical and metallurgical design.
2. Lubrication.
3. Inspection.
4. Regularly scheduled repair times.
5. Investigation of equipment failures.
6. Necessary spares and control.
7. Equipment performance data files.

With such a program, the blooming mills division of the Pittsburgh works of the Jones & Laughlin Steel Corp. have reduced mechanical and electrical breakdown mill delays 44 per cent, and have cut cost per ton 25 per cent even in spite of increased material and supply costs.

Examples of methods in which this has been done have been such procedures as testing main drive couplings on a scheduled basis, with non-destructive methods thus finding flaws and cracks before actual failure has resulted.

ACCIDENT CONTROL IN ROLLING MILLS

By CARTER KENDALL
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▲ A common meeting ground of understanding is essential to appreciation of the detailed problems that are encountered in the operation of rolling mills. One of these problems is the control of accidents. Both categories of accidents, i.e. those involving injury to personnel and those that do not produce injuries should be controlled if maximum production is to be attained. Both classes respond to the same controls, the same corrective measures and devices. Success in the solution of this problem is essential to a good production record. Unless accident control is integrated with production, the returns will be strictly limited. It should be planned and built in to the production steps right from the start.

An accident can be defined as an event that was not planned to take place. Quite obviously, to control unplanned events, an extension of planning is indicated. Three important conditions, positive interest on the part of the men, full supervisory cooperation, and adequate training of personnel must be brought about if the accident control plan, which should be integrated with production, is to be effective.

Bearing these points in mind, together with the demonstrated need for planned accident control, a method of approach is recommended that includes the analysis of each job performed, by listing each step taken. Opposite each step, the hazards of that step are recorded and against these hazards the controls that can be employed to overcome the hazards are entered. This procedure, termed "Job Safety Analysis" has proven to be very helpful. The analysis itself is made up by the foreman, rather than the safety department personnel. The foreman must discuss the analysis with his men which brings them into the picture as well. This plan of attack helps to stimulate interest of workers, ensures supervisory cooperation and serves as a training program for men and foremen as well.

If, in spite of careful accident control work, accidents still take place, the causes should be checked against the job safety analysis and all errors or omissions rectified. By this means a thorough and accurate set of analyses can be assembled that will become an excellent training aid as well as a guide for production and accident control, and both safety experience and production should improve.

DESIGN AND OPERATION OF A FOUR-STAND SEMI-CONTINUOUS HOT STRIP MILL

By H. H. WARNOCK
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▲ THE paper gives a brief discussion of the reasons for building a 4-stand semi-continuous strip mill. The paper covers the various features of the mill starting first with the heating facilities and then continuing with description of the design of the 84-in., 3-high roughing mill, the location and design of approach tables, up-cut shears and descaling cabinets. Following this is a description of the three-stands of the 4-high finishing mills, including chutes, loopers, guides and drives. Included also are the details of the design, location and operating practice of the rotary flying shears as well as the various methods of piling the flat cut skelp for various lengths from 33 to 52 ft. The paper also gives a description of the upcoiler and coil handling equipment.

In the operating section of the paper, details are given on the scheduling and rolling methods which have been established for the production of flat rolled cut product, and also the rolling and coiling practice which is used for the production of coils.

INVESTIGATION OF MATERIAL DISPLACEMENT IN MANNESMANN PIERCING BY MEANS OF MODEL WAX BILLETS

By J. L. HOLMQUIST
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▲ THE paper describes an experimental method of investigating the displacement and deformation of material which occurs in the piercing of solid billets on a

mannesmann type piercing mill in the manufacture of seamless tubes. In this method of investigation, the billets are made of a wax composition and are of two types. One type contains filaments of a different color of wax than the remainder of the billet. These filaments are parallel to the axis of the billet and are continuous through the length of the billet. The other type of billet contains alternate discs of different colored wax. The technique of billet making is described. A model piercing mill used for piercing the billets is also described.

The types of deformation observed in piercing wax billets are described. The deformations are classified into basic and redundant types. The relationship between the deformations which occur in piercing wax billets and those which occur when hot steel billets are pierced is discussed. It is pointed out that only the redundant deformations are subject to possible control in the piercing operation.

An application of the experimental method has been made to a study of the effect of the shape of the piercer point on the deformations. The results obtained to date in this study are presented.

SINGLE STACK HIGH CONVECTION ANNEALING FOR NARROW STEEL STRIP

By J. L. WHITTEN
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▲ AT the October 1951 annual meeting of the Association of Iron and Steel Engineers in Chicago, Mr. Lee Wilson gave a paper on the "Single Stack, Portable Base Annealing Furnace" to emphasize the desirability and economy of the single-stack furnace for use in the large strip and tin plate mills. The October paper did not mention the use of this furnace in the narrow strip industry, where the single stack furnace was originally used.

It is the purpose of this paper, however, to show how extensively the narrow strip industry has adopted the most modern conception of annealing design in single-stack furnaces with high convector gas circulating systems, high heat inputs, alloy inner covers and oil sealed bases to eliminate the use of sand for seals with all the attendant objections to this sealing medium for mills which must produce steel of exceptional finish and close tolerance for gages.

The paper will develop the history of annealing in the narrow strip mills and the adaptation of high speed convection equipment to narrow strip mill coil processing for annealing.

The general principles of the modern type of furnace will be discussed and present yields from this equipment given. Basic differences in construction between equipment for the large mills with sand seal inner covers and the narrow mills with oil seal inner covers are outlined. The effect of ingot segregation on uniformity of annealing is discussed, as well as the necessity for oil seals for annealing high carbon materials. The basic design ideas for convector plates are outlined.

A number of pictures of modern installations are shown and the paper is well illustrated with charts and drawings.

STEEL DEFECTS COMMONLY ATTRIBUTED TO HEATING

By GEORGE Y. BOAL
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▲ THE defects in steel which can be attributed to the heating practices are sometimes difficult to separate from those caused by other reasons, because many factors are involved in the analysis of defects. The purpose of the paper is to discuss the reasons for some of the defects encountered, and to consider the actual harmful effect on the steel.

Brief consideration is given to the chemistry of furnace atmospheres and the factors which change this chemistry, including the fuel used, ratio of air to fuel, furnace pressure, and combustion controls. Time at temperature, of primary importance in its effect on steel quality, is affected by furnace size, method of operation, and novel designs, such as high-speed heating.

After an introductory discussion of the general importance of furnaces and their operation, the various common defects are examined, with an effort made to assign specific causes and reasons for the development of the symptoms which characterize the defect. These reasons may include many factors: such as chemical effects, plasticity as affected by temperature, differential expansion and contraction, mechanical strains with uneven heating, overheating, and many others.

Since the nature of the processes are vastly different for different forms of finished product, the defects found in blooms, bars, and strip products are different and must be considered separately.

Recommendations covering heating practices designed to keep defects to a minimum are included.

AUTOMATIC CONTROLS FOR REGENERATIVE SOAKING PITS

By GRIFFIN L. ISAACS
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United States Steel Co.
Duquesne Works
Duquesne, Pa.

▲ THIS paper explains how automatic controls have been applied to regenerative soaking pits in order to decrease heating time, improve heating quality and reduce fuel rate.

The improvements were made in two stages. First, forced draft fans and automatic flue reversals were installed. Then, automatic temperature controls were added to permit complete utilization of the increased heating rate. Each stage of development is explained with emphasis on the arrangement of equipment.

The method of fired soaking used on these soaking pits is unique in that an air-fuel ratio is not maintained as air is supplied continuously at the rate required for maximum fuel flow. This continuous air system is employed to permit independent operation of each pit since two pits have common flues and a single damper.

The heating rate after each stage of development is given in terms of heating time and transit time to display the results that each part contributes to the total

improvement. The adverse effect of fired soaking without temperature controls is also explained in detail.

INERTIA STUDIES FOR MODERN MILL DRIVES

By J. F. SELLERS
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D-C Motor & Generator Design
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T. B. MONTGOMERY
Engineer-in-Charge, Control Design
Allis-Chalmers Manufacturing Co.
Milwaukee, Wisc.

▲ WHERE a consequential amount of work is done simultaneously by a number of independent drive motors in reducing steel, simultaneously on the same strip, not only are the electrical characteristics carefully chosen but also the mechanical characteristics. The motors are working mechanically in parallel on the same load.

In the tandem mill, a notable example, since it is necessary to accelerate and decelerate the mill during the rolling of each coil, the inertia constant WK^2 of motors needs be as low as practical, particularly in high speed mills. This is necessary to keep from overloading machines beyond their short time current capacity. It follows that motor torque must be added during acceleration and subtracted during deceleration in the required amounts with exactness if constant tension is to be held in the strip. Accuracy is, required if tension is to be varied in a given relation, as speed varies.

Therefore, the greater the WK^2 and required accelerating currents, the greater the demand for speed of response and accuracy in the control equipment.

The logical question then is why not design motors with armatures of small diameters and long core lengths and reduce the WK^2 to lower values with modern demands for higher speed mills. One might point to specialized applications in relatively small hp sizes where this has been done such as table rolls.

To obtain the most delivered torque at specified speeds, for a minimum quantity of material, iron, copper, etc., finite physical relationships must be adhered to, otherwise the gain in one characteristic is made at the expense of increase in some other. Present WK^2 values could be lowered, however, over a period of years these relationships in main drive motors have been built up by experience. The design limitations are given in this paper. With increase in mill speeds, the WK^2 of the mill, referred to the motor shaft, has increased to the point where, the mill is such a large per cent of the total that, further reduction in motor WK^2 is uneconomical in reducing the total for mill and motor. For illustration the development of motor sizes for a medium sized tandem mill is made.

Likewise, when motor sizes have been set up for the largest torque requirements of such a mill, there is a given ratio of accelerating currents to steady state load currents for this maximum load, and for a given rate of acceleration as the thickness of strip being rolled is reduced, the motor steady state load current is reduced but the accelerating current remains constant. With the thinner strip, strength of the steel decreases. Thus the sensitivity and accuracy required of control equipment increases. For example, if the motor load current is 33 per cent of full load, rolling light strip and the control sensitivity is $\pm$ 1 per cent of full load current, its sensitivity becomes $\pm$ 3 per cent for the light strip. If accelerating current is 75 per cent of full load current, it is 225 per cent of the current required to roll the light strip.

The ratio of accelerating current to steady state load current then requires study for the lightest gages to be rolled. This ratio has given trouble on some mills that have been built.

VARIOUS APPLICATIONS FOR COMPOSITION NON-METALLIC BEARINGS

By HARRY GILCHRIST
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▲ THIS paper describes the development of composition bearings starting with the lignum vitae bearing which is the grandfather of the heavy duty non-metallic bearing. Much work was done with this material in order to get and develop uniform high quality. The next step was the development of the composition bearing. These may be classified into two types: laminated bearings and the fully molded type bearing.

A laminated bearing is so-called because sheets of duck canvas, burlap or linen are impregnated with a condensation resin binder and moulded together into the radial form. The thickness of such radial type laminated bearings is made up by the required number of such impregnated sheets.

By this method, it would be impractical to produce a bearing having a flange to absorb the end thrust. Therefore, most manufacturers in making this type of bearing recommend a separate thrust flange which is merely cut out and machined off a flat moulded slab. The separate thrust flange has its advantage in such mills where over years of operating experience it has been shown that the bearing proper lasts from three to six times longer than the thrust flange.

The fully moulded bearings have advantages as they not only can be more quickly installed by removing the old type brass bearings, but in the bearings themselves have a universal grain edge permitting them to be made as a one-piece bearing with any shape, size or thickness of flange. The resistance against wear or friction is uniform in all directions. The wearing does not change during operation, and the structure is uniform throughout. There are now, for instance, certain formulaes whereby the size of a fully moulded bearing can easily be derived from the diameter of the roll neck.

In composition bearings, whether they are made of laminated or shredded material, or whether they are made of virgin vegetable fibre, the most important thing is to produce a bearing which is absolutely homogenous, and not having too large a percentage of resinous contents, and a smooth, hard wearing surface. Bearings of the composition variety should have a relative small percentage of binding elements, should be strong enough to assure the maximum amount of crushing strength, uniform smooth running surfaces and resistance against wear.

EFFECT OF INGOT MOLD DESIGN *on Mold Life*

By A. JACKSON
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. . . . carefully planned design and operating procedure can lengthen mold life and reduce mold costs . . . .

▲ TWO mold and two bottom plate designs are compared in general terms, whilst for the later type, the results of detailed experiments designed to indicate the effect of variables in conditions of use, are shown.

The two types are referred to as 10-ton O.T. (open top) and 10-ton T.T. (taper top) molds, and each type has its own design of bottom plate. That for the 10-ton O.T. has a shallow central dish, is common to several types of mold, and the "as cast" surface is in control with the mold.

The 10-ton T.T. has a machined face on both base of mold and upper surface of bottom plate. The two are located in position by lugs and spigots, and the dish in the plate coincides exactly with the inner cross section of the bottom of the mold. The mold design is illustrated in Figure 1.

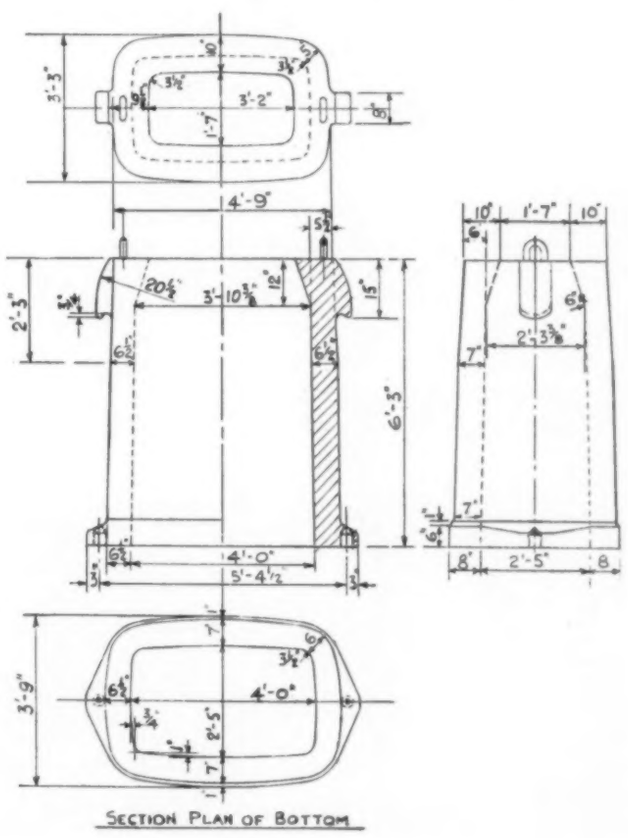
Although the 10-ton O.T. had a low mold consumption per ton of steel, efforts to give further economies in mold metal usage resulted in the following changes in design:

1. The upper walls were thickened to give a taper top, to prevent the formation of vertical cracks on the top, narrow side of the mold. The resulting overhang also helped to avoid steel being poured on to the mold wall due to careless teeming. These aims were achieved.
2. A lug on the narrow side, at the bottom, was necessary to allow the locating pins on the bottom plate to register. The added strength in these mold lugs was expected to prevent vertical cracks forming on the narrow side. This was not achieved, although the incidence of cracking was reduced.
3. The broadside of the mold was thickened and a band 1 in. thick and 6 in. deep cast at the base to reduce cracking on this side.
4. The bottom plates for the 10-ton T.T. were made to carry two molds, in place of the former design which carried one. This new plate was much heavier per ton of steel cast. It was also thicker to enable a deeper cone to be produced, stronger to avoid early cracking, but probably most important, its length was so designed that the molds on the cars throughout the heat were uniformly spaced and could not be bumped during shunting, to allow hot faces to come into contact and thereby reduce mold life.

The bottom plate designs indicate that teeming, in all tests shown, was of necessity direct.

The results of the comparison between the old design, the 10-ton O.T., and the new design, the 10-ton T.T. in general average comparative practice showed

Figure 1 — Details of 10-ton T.T. mold.



an average consumption of 17.5 lb per ton ingots for the O.T. and this was reduced to 14.6 lb per ton for the T.T. Bottom plate usage decreased from 15.1 to 4.0 lb per ton.

A number of tests were made on the new 10-ton T.T. mold. The trials were designed to evaluate the effect of the following factors on mold life:

1. Position of the mold in the heat during teeming.
2. The effect of long and short tap to strip times on the life of molds at approximately the same temperature when receiving the heat of steel.
3. The effect of long and short tap to strip times on mold life when used cold (standing time of not less than 36 hours between heats).

The trials with long cooling times lasted over a year, meanwhile the others were each repeated on two occasions.

The fundamental reason for making these tests was to estimate the monetary value of increased mold life arising from more rapid stripping. Only the effect on mold life is recorded here.

DETAILS OF TESTS

Effect of position during casting — Six 10-ton molds disposed on three casting cars, were used in each trial heat. The fourth car contained one 10-ton and one 6-ton mold, but was not included in the test.

Effect of tap to strip time — Two heats were in use, the first being stripped as quickly as possible after tapping, with a minimum of 30 minutes. The second was held back to strip in 120 minutes. The strip to tap time of these two heats varied, it being found that, with rapid stripping, the molds were ready for the next tap in eight hours, but with the long stripping time, 12 hours cooling were necessary to bring them down to the same temperature.

Effect of strip to tap time — Two further heats were stripped in approximately 30 and 120 minutes as above but were allowed to stand at least 36 hours between taps to ensure that they were cooled down to atmospheric temperature.

Selection of molds — All molds used in this test were first examined to ensure freedom from obvious physical defects, such as laps, cold shuts, or top porosity. No special analyses were used, those shown being normal for the makers foundry.

Each mold contained a circular splash can about 18 in. diameter.

INFORMATION COLLECTED

The information collected was as follows:

1. Temperature of the bath at tapping and between first and second ladles.
2. Steel quality, size of nozzle, ladle skull, condition or stopper and ladle from the furnace.
3. Time filling each ladle, exact time of filling each mold, remarks on pouring conditions.
4. Time each ingot was stripped.
5. The mold was examined before the next tap to see that it was correctly set on the bottom plate, complete with splash can, etc. This examination also enabled the development of defects to be recorded.

Eight heats were examined in total, three with a short tap to strip time and normal strip to tap times; three with a long tap to strip time and normal strip to tap time; one with short and one with long tap to strip time, but both having a sufficient strip to tap time to enable them to cool to atmospheric temperature before being used again.

RESULTS OF TRIALS

Failure has been classified into three types:

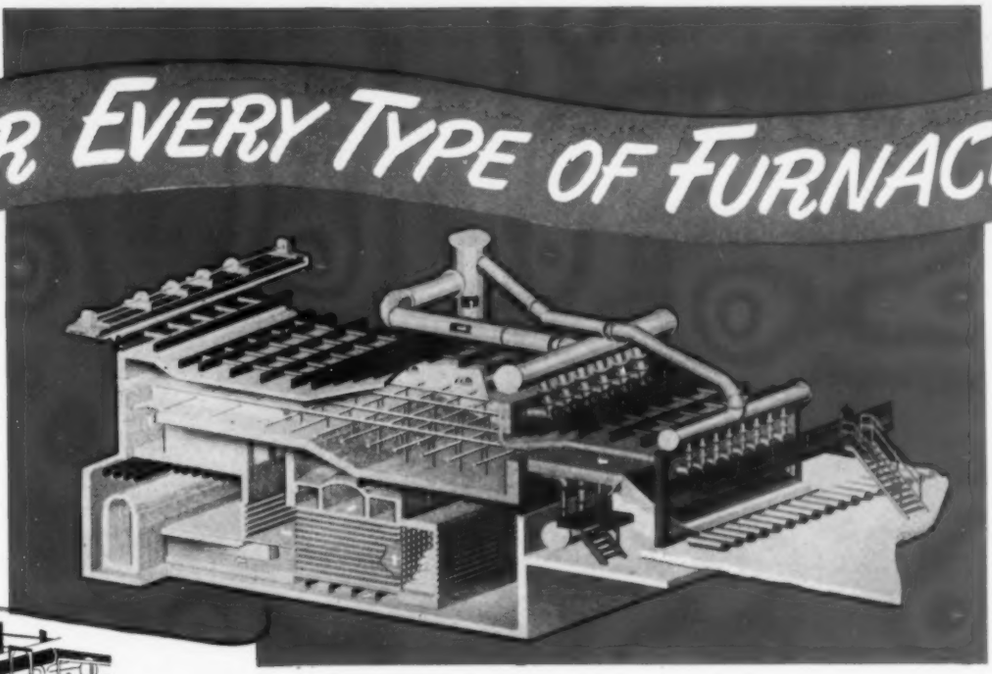
1. Wearing of the inside surface, along with horizontal cracks on the broad side, later extending vertically downwards.
2. Vertical cracks on the broad side, i.e., vertical cracks which commenced as such and extended.
3. Vertical cracks on the narrow side, i.e., on the lug side.

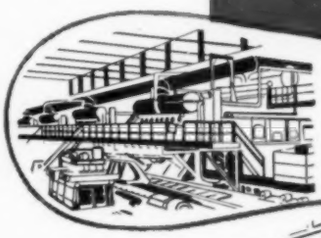
Lb mold per ton ingots is calculated from the total weight of ingots made in each mold and the mold weight. With normal use, a short tap to strip time gives a mold consumption of 10.4 lb per ton, while a long tap to strip time gives an average of 18.9 lb per ton. The two casts with the long cooling time between use, have an increased consumption of about 10 per cent above those with normal cooling time.

Figure 2 — Typical final inside surface of mold with short tap to strip time. Final life 216.

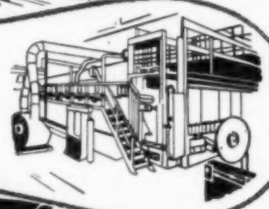
Figure 3 — Typical final inside surface of mold with long tap to strip time. Final life 114.

FOR EVERY TYPE OF FURNACE

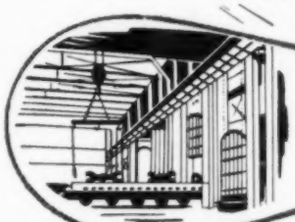




SLAB, BLOOM, BILLET, BAR HEATING FURNACES

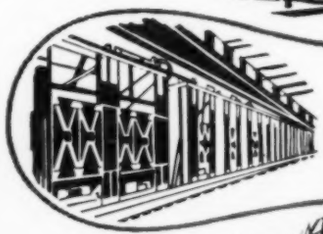


CONTINUOUS PIPE ANNEALING FURNACES

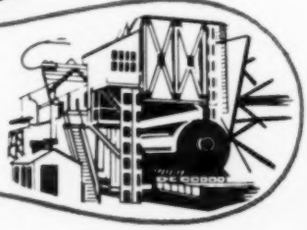


CAR BOTTOM TYPE HEAT TREATING FURNACES

ROTARY HEARTH, BLOOM AND BILLET HEATING FURNACES



BOX ANNEALING FURNACES



STRESS RELIEVING FURNACES

ALSO ROLLER HEARTH AND OPEN HEARTH FURNACES

..rely on RUST *from start to finish**

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The average temperature at which the sample passer commenced to tap the furnace normally increases during the tapping operation; thus, when the steel strikes the ladle, it is a little hotter than the "tapping" temperature.

It is well known that in large tilting furnaces, the temperature of the steel in the first ladle is normally slightly cooler than the remainder because it comes from the bottom of the furnace. Furthermore, the ladle takes a little longer to fill due to the time which elapses before the taphole is washed out to its full, normal size, which normally occupies three or four minutes of the ladle filling time. The difference in temperature, between the first and later ladles, is not very great.

Most of the steel was between 0.12 and 0.20 per cent carbon, balanced in type, and generally of as uniform quality as it is possible to use in a steelworks.

Molds used at a temperature of about 50 C with other conditions as uniform as practicable, showed that decreasing the tap to strip time from 127 to 44 minutes increased the average mold life, with the normal method of failure, from 113 to 216.

If the molds were allowed to cool for at least 36 hours between heats, thus being used each time at atmospheric temperature, their life was reduced by about 10 per cent, with both long and short tap to strip times.

Molds with the long tap to strip time required about 45 per cent longer cooling time than those with the short, to fall to the same temperature; thus it is obvious that a constant tap to tap period for re-use does not indicate constancy of operational conditions in practice.

The normal method of failure, in all tests, was basically due to a horizontal crack on the broadside of the mold, frequently accompanied by a vertical crack growing downwards from the center, but there was a fundamental difference in the type of crazing that developed. With the long tap to strip times, the crazy pattern was of small mesh and the markings were depressions. Rapid stripping, however, produced a very coarse mesh of projections, each subdivided by a fine crack. From some part of this pattern, major failure commenced.

With short tap to strip times the molds probably failed essentially due to repeated heating and cooling. With long stripping time, however, the mold temperature must obviously be much higher when stripped, and this resulted in the surface being torn away by projections on the ingot. Once sizable defects had formed in a mold, its life rapidly concluded.

A few molds failed prematurely due to vertical cracks on the narrow side and it is tentatively suggested that this type of failure has its origin outside the sphere of the user.

Neither order of teeming nor chemical analysis, within the limits shown, appear to have any important effect on mold life. The first mold of each heat, with its "hot" and "cold" side, did not differ in life from the remainder, but the evidence appears to indicate, with rapid stripping, that had both sides been "cold," then life would have been increased.

Due to the manner in which mold wear took place, ingots from the later lives of heats with a long tap to strip time, had a far worse surface appearance than those from rapidly stripped heats. Sample ingots were photographed, rolled to slabs, again photographed and finally rolled to plates, often without producing any defectives which could be attributed to the rough ingot surface. It was concluded that the effect of mold surface on defectives was small relative to that of the unsolved difficulties of cracks, due to steel temperature, composition or teeming speed, of shell due to faulty teeming or of defects due to sub-surface blowholes.

The number of tests reported here may appear, by some standards, to be small, but it is believed that the care with which they were made gives practical significance to the conclusions enumerated.

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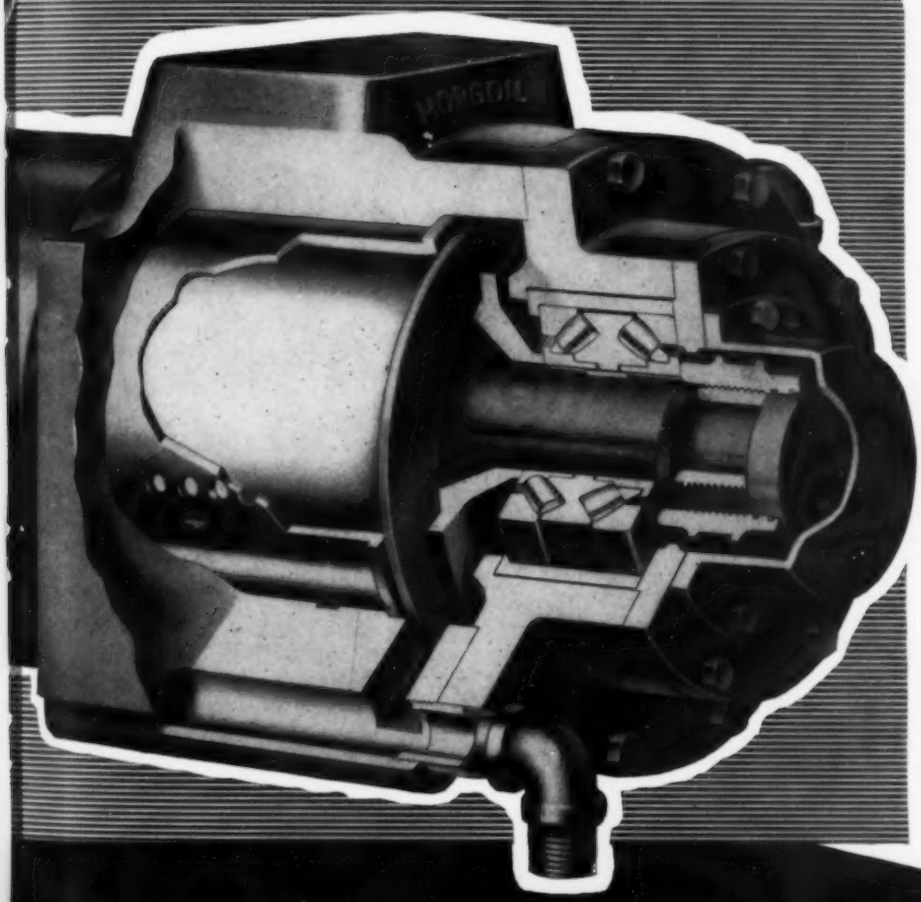

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MORGOIL
ROLL NECK BEARINGS

Cropping Losses Reduced

BY ELECTRIC HOT TOPPING

By TUNIS L. HOLMES
Superintendent
Electric Products Department
The M. W. Kellogg Co.

▲ The steel industry has been constantly searching for methods of eliminating or minimizing top shrinkage or piping in steel ingots. Obviously the aim is to reduce the amount of top metal that must be sheared from the ingot to leave a larger billet of sound metal, which results in less scrap to be handled and reprocessed. The possible savings will increase as the problem is attacked on killed steel ingots, from the cheapest carbon steels through the very expensive superalloys.

Many methods have been tried to overcome the formation of pipe by keeping the metal at the top of the ingot molten until the remaining metal has solidified. The most common method has been the use of a refractory collar placed on the top end of the mold. Sometimes the collar is preheated to a high temperature just prior to teeming and a sufficient quantity of metal is poured to substantially fill the refractory collar. Insulating and/or exothermic materials of varying kinds then are placed over the metal in the collar to delay final solidification. While this method is used almost universally by steel mills, it is not entirely satisfactory and hence the search goes on for something better. Special insulating at the hot top, electrical discharges to add heat to the top, gas heated hot tops and induction heating have been tried. Electric arc heating was initially developed several years prior to 1924 and attempts at practical application started in that year.

After several years of development work and three years of production application in eight different steel-producing plants, a process showing considerable promise is now being used. Known as the Kellogg electric hot-topping process, it supplies heat to the top of the metal in an ingot mold with the metal covered by a protecting blanket of flux to promote solidification with a minimum formation of defects due to shrinkage, the ingot metal at the same time being protected from contamination. The flux material is a development of the Kellogg Co. and is formulated to have physical, chemical and electrical characteristics that protect the teemed metal from the atmosphere and retard heat losses in such a way that the top end of the ingot is maintained in the liquid state, while the rest of the ingot is allowed to solidify from the bottom up. Furthermore, the flux material facilitates absorption of segregates and impurities liberated in the metal during solidification, and promotes generation of heat and its proper distribution to the top of the teemed metal.

The heat is supplied in a manner and in quantity controlled to provide a reservoir of molten metal of gradually diminishing size which feeds heat to the solidifying metal beneath as volume changes take place due to solidification. The heating cycle is continued until solidification is sub-

Figure 1 — As the current is turned on the pool begins to form.

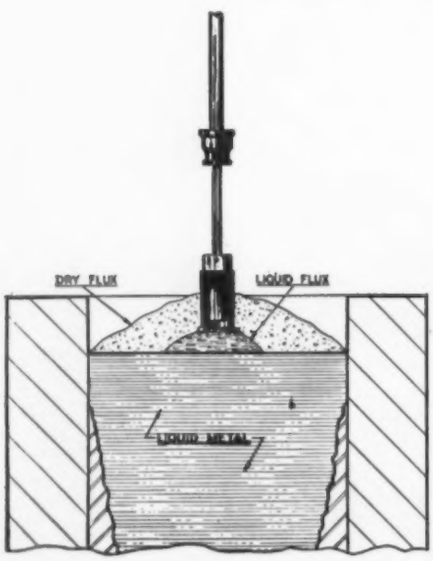


Figure 2 — The cup which is formed protects the mold from excessive heat.

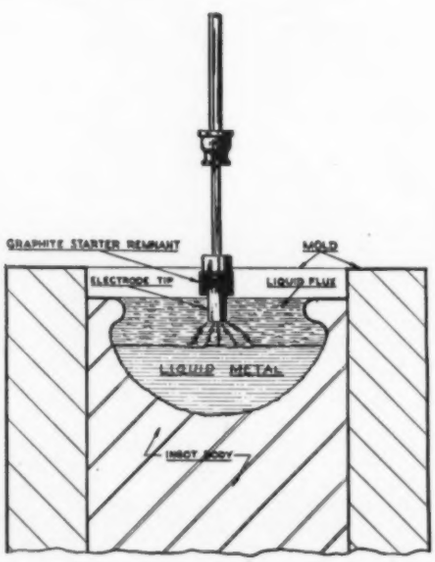
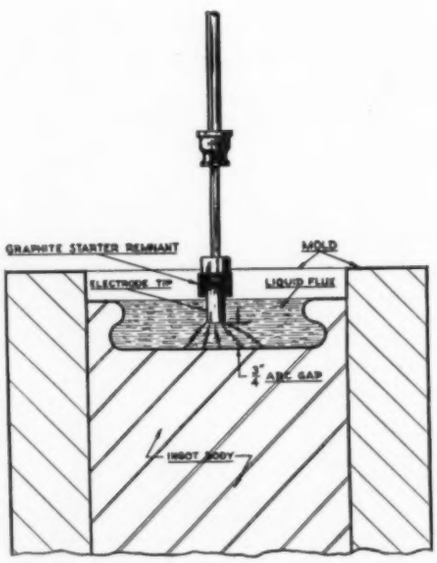


Figure 3 — At the end there is only a small pool of liquid metal



stantially completed. The heat is generated by the discharge of electric current from the end of a nonconsumable electrode submerged in the flux without detrimentally affecting the required properties and characteristics of the resulting ingot.

The equipment consists of a power source, an automatic control, an automatic head, a nonconsumable liquid-cooled electrode assembly with a graphite "starter" and a circulating system for the coolant.

This equipment may be arranged in any one of several ways to suit the plant layout since it may be operated from the pouring platforms with ingot molds set up on the floor, or from the floor with the ingots in pits. The power unit, the control unit and the pump unit customarily are located in a substation behind the platform. The control unit automatically establishes contact between the electrode and the steel as soon as the electrode is energized, after which the proper operating current and voltage is maintained during the hot-topping period, and finally shuts the power off and withdraws the electrode.

The operators' switch and coolant valves are placed within convenient reach as they are the only controls that are manipulated by the operator —the entire cycle of operation being automatic once the switch is turned.

The head units and electrodes are stored below the platform directly behind the front wall when not in use. The electrode assembly, which weighs about 25 lb, is the only part of the equipment that must be handled at any time. It is connected to the power and coolant supply lines through flexible leads. A double trap door in the platform provides access to the electrode units.

When preparing for teeming, the operator removes the electrodes from below the platform and sets one each on a pin positioned to the left of the mold and below its top edge. In this position the electrode assembly will not interfere with the ladle or ladle crew during teeming of the heat.

The mold support, whether a stool, rails or plate, is permanently grounded.

The design of the various parts of the equipment has been standardized as an aid to simplified operation and to reduce the cost of maintenance. The same size of electrode is used in hot-topping 8-in. × 8-in. ingots as for 90-in. × 40-in. ingots, the only difference being in the number of electrodes used.

As the size of the ingot is increased, the number of kwhr required to hot-top it will increase. Where a single electrode is used for the various sizes, the actual topping cycle is varied by adjusting the power input and controlling the time. When the ingot size exceeds the capacity of a single electrode, more are added as required. For a 90-in. × 40-in. ingot, weighing 110,000 lb, eight electrodes were used during an actual production test.

Standardization increases the flexibility of the process from an operational and maintenance standpoint, and also allows a minimum of operating and service parts in inventory.

The graphite starter is the only expendable part of the electrode. It too is a standard part, made of "National"* electric furnace graphite. An internal thread allows quick replacement after each use of the electrode. The function of the graphite starter is to provide a quick, intensely hot arc to initiate the heat cycle of the process. A small portion of the graphite is burned away to expose the liquid cooled electrode which then maintains the arc during the remainder of the timed period. There is no free carbon liberated and the small amount of ash that results is picked up by the molten flux. The graphite starter is a very inexpensive item.

The operation of the unit is both quick and easy. Before a heat is tapped the molds are set up in the usual way. The refractory collars are omitted unless used for some special purpose. The electrodes are made ready, the power supply and control circuits are turned on and the coolant pump started. After each mold is filled, a fixed amount of powdered synthetic slag is added, the electrodes placed in operating position and the switch turned on.

These combined steps require only a few seconds and in no way delay or disturb the teeming operation. The ladle crew is not concerned with an electrode after it is started, because each is automatically controlled throughout the entire hot-topping cycle, including shutoff and withdrawal. No extra labor is required nor is any extra time required for stripping.

The slag is composed of easily obtainable raw materials and its proportionate composition must fall within fixed limits in order to sustain efficiency. The slag has a two-fold function: it supports the electrical discharge from the electrode, and excludes the atmosphere from the liquid steel.

In practice the slag is melted by the electrical discharge and forms a liquid pool on top of the metal. Figure 1 shows the pool beginning to form the instant the current is turned on. The amount of power is carefully controlled so that the metal at the top of the ingot will begin to solidify from the outer edge toward the center and form a "cup" as shown in Figure 2, which protects the mold from excessive heat. The proper amount of slag has been found to be about one per cent by weight of the ingot size. Solidification continues until there remains but a small pool of liquid metal, as shown in Figure 3. The small amount of top metal that must be cropped is shown in Figure 4.

The power consumption for all ingot sizes and grades tested to date varies from 30 to 40 kwhr per net ton. The measured consumption during one year of hot-topping ingots from 9-in. to 15-in. square averaged a little less than 40 kwhr per net ton, with the units operating at an average of 40 v, 500 amp.

The capital investment required for the installation of the process cannot be given in a general statement because the physical layout of each melt shop and the methods used in teeming vary. It can be said, however, that for the several plants already equipped, it is indicated that the

Figure 4 — A minimum of metal is cropped from the electric hot-topped ingot.

*The term "National" is a registered trademark of Union Carbide and Carbon Corp.

Figure 5 — Electric hot-topping units in operation. Tips of electrodes are submerged below the surface of the molten flux.

Figure 6 — Removing electrode unit from ingot at completion of hot-topping cycle.

whole investment can be paid off in from one to two years. Estimates show the operating cost, including amortization, power, labor and raw materials, to be about the same as present operating costs when using refractory tops.

Many grades of steel have been electrically hot-topped from plain carbon steel through most of the stainless grades, both chromium and chromium-nickel, valve steels, die steels, high-speed tool steels and high temperature superalloys. The increase in yield has averaged between 5 and 8 per cent with many figures showing even greater increases. Attention must be called to the small difference of only 1 to 1½ per cent between the maximum and minimum yields from an entire series of heats of various grades ranging from shallow piping chromium-molybdenum types to deep piping valve steels, as being significant of the consistency of the operation which enables the shearman to cut much nearer to the optimum crop than is possible under present practices.

In addition, it has been found that deep-piping steels can be hot-topped just as readily and show as high yields as shallow-piping steels, and the procedure for a given size of ingot is the same regardless of the grade of steel treated.

Production runs show clearly that mold life is not shortened by the use of the process in either an open mold or when a refractory collar is used. When the process is carried on inside a refractory collar the yield can be increased by about 1 per cent over that obtained in an open mold.

Chemical analyses show that the composition of the steel is not disturbed.

The economics of using the electric hot-topping process is readily apparent and can be calculated for each plant operation on the basis of the established yield increase and the resulting decrease in cropped scrap.

STEEL PLANT REQUIRES NEW RIVER INTAKE

By CHARLES W. GRANACHER
Project Engineer
Dravo Corp.
Pittsburgh, Pa.

▲ The $400,000,000 expansion program of Jones & Laughlin Steel Corp. includes 11 new 250-ton capacity open-hearth furnaces at the corporation's Pittsburgh works. Because the water needed for these new furnaces and the associated quenching and other operations was not available, a new river intake had to be constructed. The contracting division of Dravo Corp. was awarded the contract for this facility which has sufficient capacity to supply other mill needs as well as the open-hearth project.

The new intake is located on the south bank of the Monongahela River at the foot of 34th Street and the new open-hearth shop is along Carson Street between 29th and Felker Streets.

The reinforced concrete substructure of the intake is 145 ft 9 in. long by 45 ft wide and extends from 16 ft below normal pool to 33 ft above pool. An intake forebay is provided which extends 12 ft riverward of the main structure. The superstructure is of

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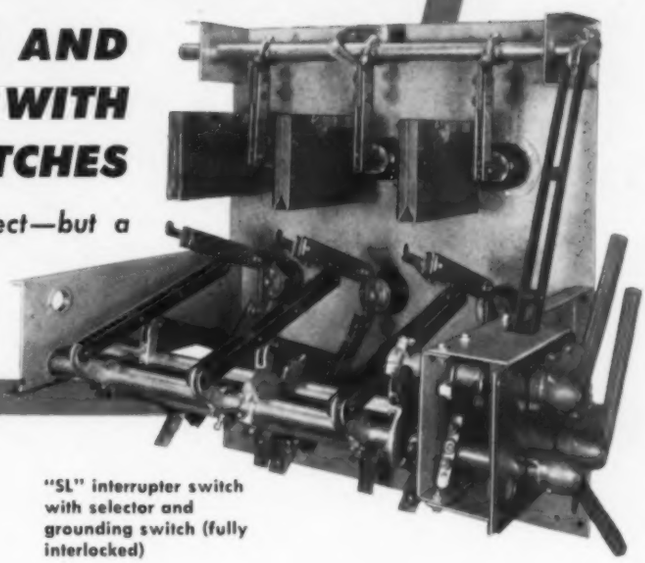

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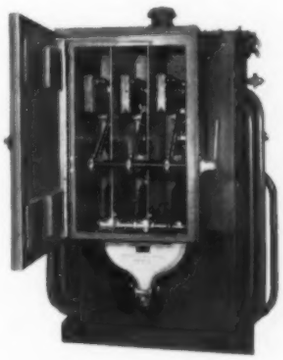

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Each operating handle is equipped with a latch to prevent blade opening under short circuit currents. The latch is released by means of a trigger located on the operating handle and can be padlocked to prevent unauthorized operation.

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Figure 1 — Exterior view of new river intake at Jones & Laughlin's Pittsburgh works. At the right can be seen the new lime storage silos and the lime slaker building from which lime is fed automatically into the wet wells.

concrete block construction, 22 ft high, with steel columns supporting a 15-ton traveling overhead crane and steel roof trusses. The roofing is of corrugated asbestos.

Raw Monongahela river water on its way to the pumps flows under a steel box float which skims off large floating debris and through bar screens made of railroad rails into three separate wet wells. In each well is a Link-Belt traveling screen having 6-ft wide baskets of copper wire screen cloth with $\frac{3}{8}$-in. square openings. In back of the traveling screens lime is added as needed to reduce the acidity of the water to a tolerable level. At the front and rear of each wet well is a 48-in. wide by 84-in. high motor operated sluice gate which permits isolating and emptying any one of the three wells for screen repairs and cleaning. From the wet wells, the water flows through a tunnel under the main intake floor, through 48 in. by 84-in. sluice gates, into one of two pump suction chambers. From here the pumps pick up the water and start it on its way to the furnaces.

At present three pumps are installed but space has been provided for a fourth unit when future water demands exceed the present capacity. The middle pump has a double suction line, one leg of which extends into each of the two pump suction chambers. Thus two pumps can be kept operating when one chamber is shut off for cleaning or pump repairs.

The three main pumps are DeLaval single stage horizontal units, driven by 1250-hp motors. They operate at 720 rpm and each will deliver 21,000 gpm (30 mgd) at a total dynamic head of 192 ft with a 12-ft suction lift. They have 30-in. diam suctions, 24-in. diam discharges and are equipped with a fully automatic priming system.

After emerging from the pumps, the water passes through "Andale" rotary strainers which remove the fine materials not caught by the traveling screens. By now the screened and limed water is ready to play its part in the making of steel. It leaves the intake in two 36-in. steel pipelines and after passing through a drainage sump pit, just upstream of the intake, where pressure and volume is "Bailey-Metered" by the orifice method, it is piped to the locations of its eventual use.

Just downstream from the river intake is located the liming plant. Here from either of two 50-ton capacity steel silos, pebble lime is fed to two 2000-lb per hour "Omega" continuous lime slackers. The quantity of lime water fed to the wet wells as mentioned before is automatically regulated by a "Bailey Meter Co." and "Leeds and Northrup" lime control system.

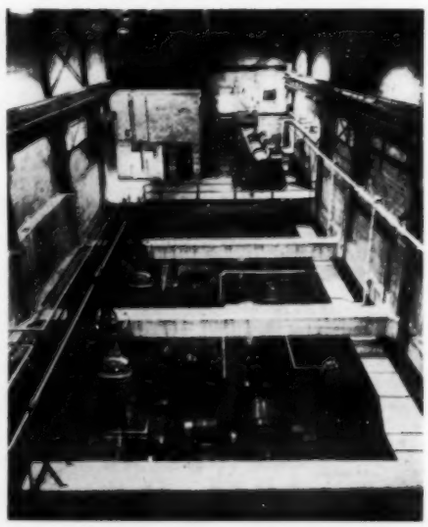
Besides construction of the pump house, Dravo's contract also covered the design of the structure. During the 1936 Pittsburgh flood the river rose to elevation 742 at the intake site. However, due to flood control dams that the U. S. Engineers have built on the head waters of both the Allegheny and Monongahela Rivers the estimated future high water is elevation 733. To guard against exceptional floods in the future, J & L required that the river intake be designed to withstand flotation and hydrostatic pressure if the river should rise to elevation 743, the top of the concrete substructure.

Since the intake is built on a sloping river bank, steel bearing piles, driven to rock, were used to support the weight of the structure. The front row of piles were battered to resist the horizontal thrust of the river bank.

The floors at elevations 698 and 715 were extended past the walls on the back side to increase the weight of the structure. Also the upstream end wall was made one ft thicker than the other walls for added weight. The total weight of the structure is greater than the weight of the volume of displaced water with the river at elevation 743. In this computation, the uplift value given the bearing piles was their dead weight only.

As screened openings through the front walls of the wet wells at eleva-

Figure 2 — Each of the three 21,000-gpm pumps, visible in this interior view, is driven by a 1250-hp motor. In the background are the three traveling water screens. The concrete struts, spanning the pump room, reinforce the outside walls against external water pressure.



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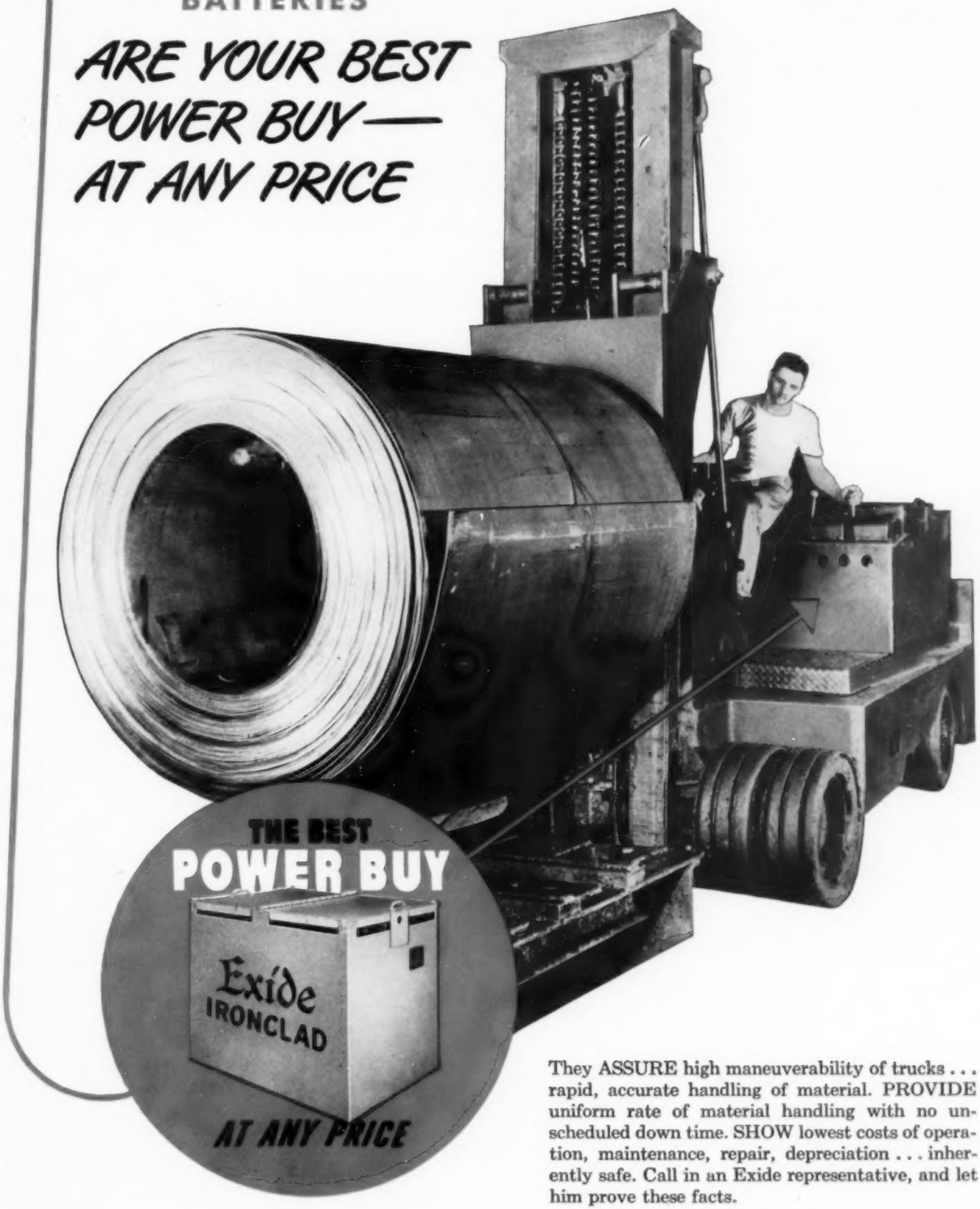

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tion 715 prevent pumping out the wet wells, tunnel, and pump suction chambers when the river is above that elevation, the walls of these parts were designed to resist water pressure with the river at elevation 715. The walls and floor of the main pump room, however, were designed to resist water pressure with the river at elevation 743. The 4-ft thick floor was designed to resist uplift on a span from wall to wall. The walls were reinforced vertically to span from the floor to a horizontal beam at elevation 735 with the part above being designed as a cantilever. These horizontal beams are supported by concrete struts at the same elevation which make the spans of the beams along the sides of the building 21 ft long, but the beam along the upstream end of the building spans the full width of the structure. At the downstream end of the building these beams and struts are replaced by a concrete slab at elevation 735 to furnish a working platform.

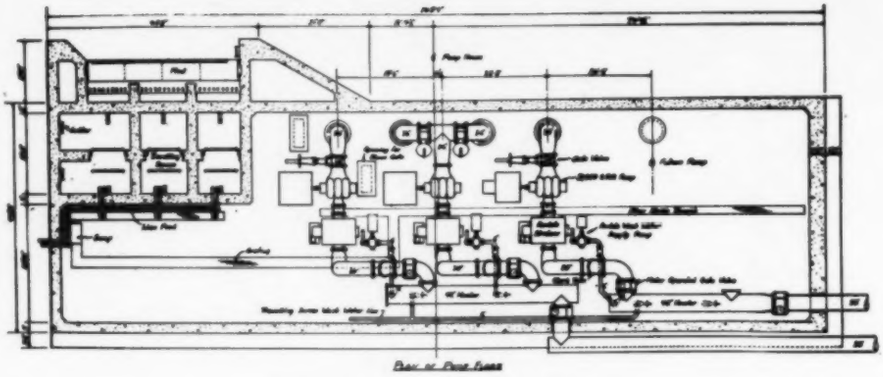
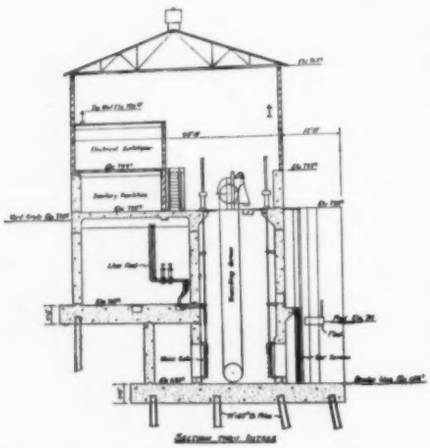


Figure 4 — Plan of pump floor.

Figure 3 — Section through intake.



The portion of the intake below the bottom of the main pump room floor was constructed in a single skin cofferdam of steel sheet piling. After the concrete had been poured to elevation 711, the front row of cofferdam piling was blocked to this concrete and earth berms with their tops about 6 ft above pool, were built connecting the upstream and downstream ends of the front wall of the coffer to the river bank. Then the cofferdam bracing was removed and the two ends and the back row of sheet piling pulled. This method allowed the remainder of the intake to be built in the open.

The Machinery division of Dravo Corp., working with the Contracting division, furnished and installed the pumps, piping, equipment and superstructure. Original general layout drawings were made by Swindell-Dressler Corp. which also had charge of field engineering and inspection. Design and detail drawings were prepared by Dravo and approved by W. H. Wachter, assistant chief engineer of J & L. The writer was project engineer for Dravo.

X-RAY GAGE MEASURES PIPE WALL THICKNESS

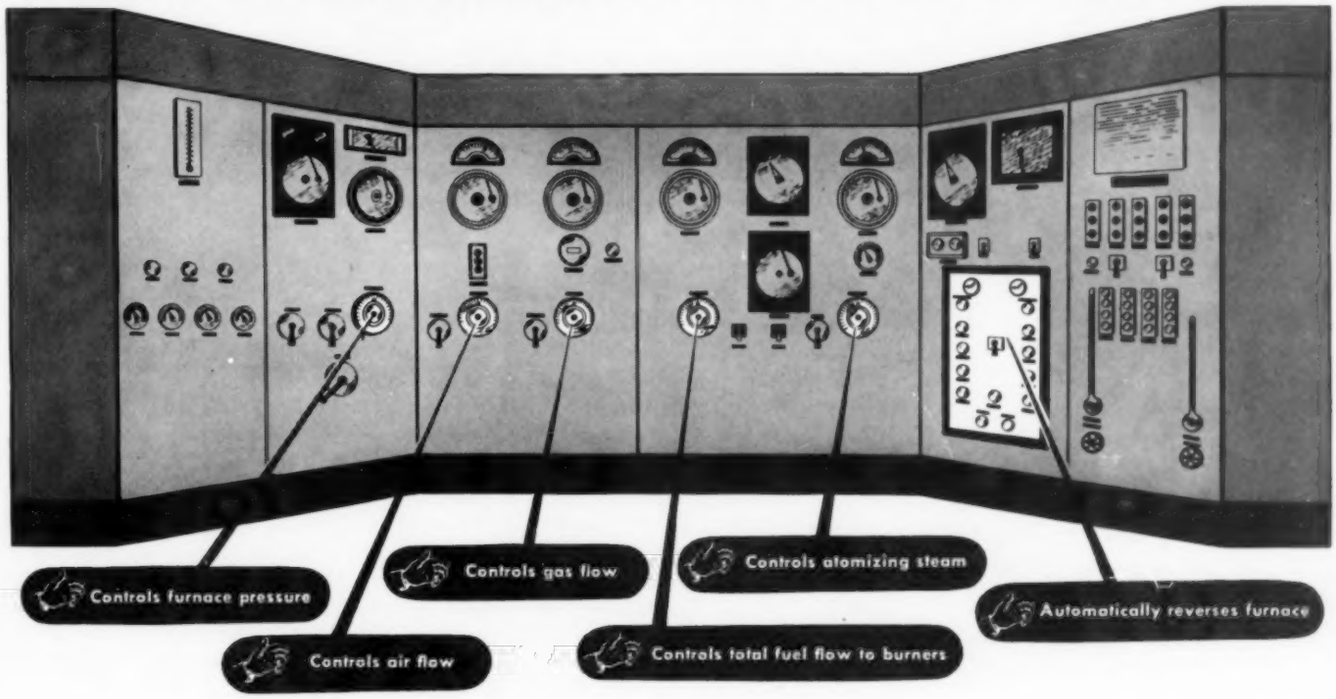
▲ One of the important finishing operations in the manufacture of seamless steel pipe consists of cutting off or cropping the ragged or irregular ends that are inherent in manufacture. Furthermore, excessive eccentricity near the pipe ends causes wall thickness variations and any area that falls below the minimum thickness permitted by the applicable specification must be cut away.

The correct crop length may vary in a single rolling from a few inches to several feet. Without an adequate and accurate device for determining this length, cropping is a hit-and-miss proposition, often of a costly nature. If insufficient crop is taken the pipe must be recut, resulting in a considerable increase in the cutting time and cost per ton of finished product. On the other hand, if more than the necessary length is cropped, good material is wasted.

Various instruments and gages used over the years for determining the cutting-off point have had some undesirable limitation, from the standpoints either of accuracy or of manipulation. But X-ray operated pipe wall thickness gages recently installed at the Ambridge plant of the Spang-Chalfant division of The National Supply Co. are proving very satisfactory in the performance of the detail, with considerable cost savings in material and labor.

These instruments are high precision, non-contact, continuously indicating electronic micrometers which gage the thickness of the pipe wall and automatically mark under-gage areas for determining the crop point. They check wall thicknesses ranging from 0.050 to 1.500 in. within an

Extra Hands for the OPEN HEARTH OPERATOR with ASKANIA Automatic Control



This is modern Open Hearth control—completely automatic but flexible. In the hands of your operators, it is a tool that helps them make more steel for less money.

No control takes the place of the skill and judgment of an experienced open hearth operator. But an Askania installation adds to his skill by putting accurate and dependable controls at his fingertips.

In a panel like the one above, all the necessary controls are there. The complete record of all that happens lets the operator duplicate his results heat after heat.

Furnace pressure control is often considered the most important single control on an open hearth furnace. Air flow and total fuel flow may be controlled independently, or they may be proportioned to each other. Gas flow may be controlled by a measurement of roof temperature. Flow of atomizing steam to the burners is closely regulated to the operator's setting. Reversal of the furnace is actuated by checker temperature, temperature difference, or a pre-set time cycle; or the operator can reverse by push-button or manual control.

Steel men rely on Askania controls—common-sense controls that make their jobs easier and the results better. Askania equipment is simple and sturdy. It's made to do the hardest jobs for the longest time.

Ask for Bulletin 115, Askania Open Hearth Furnace Control.

ASKANIA HY-PERFORMANCE HYDRAULIC Controls

ASKANIA REGULATOR COMPANY

240 E. ONTARIO STREET • CHICAGO 11, ILLINOIS

A Subsidiary of General Precision Equipment Corporation

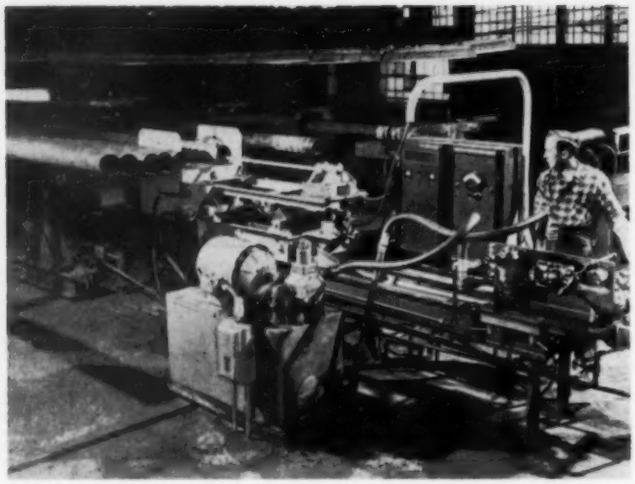


Figure 1 — Wall thicknesses of pipe ranging from 0.050 in. are determined within an accuracy of 1 per cent by X-ray pipe wall thickness gages. As shown in this general view, the X-ray generator and pick-up tube are mounted on a hydraulically operated carriage closely aligned with the rotating rolls.

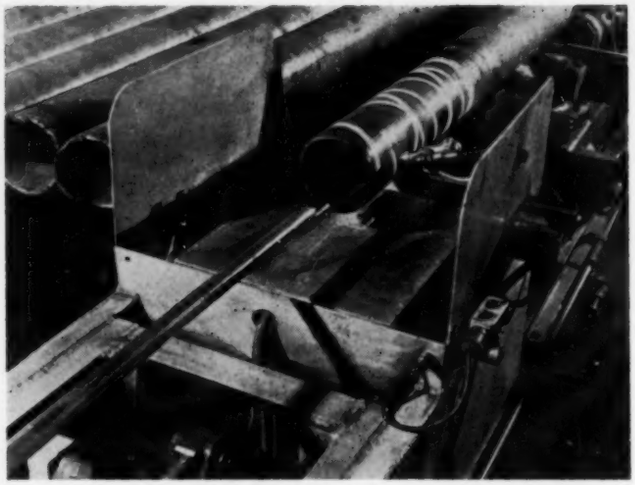


Figure 2 — A close-up of X-ray pipe wall thickness gage, showing probe tube about to emerge from inside of pipe after completion of check. Note paint-sprayed line indicating under-gage area to be cropped off. Opposite end of pipe will be checked on a similar machine.

accuracy of 1 per cent. They can be used to check pipe with inside diameters of 3 in. or larger; and smaller diameters may be checked by using specially designed probes.

In the sequence of mill operations, the X-ray gages are located immediately beyond the roll straightener. Pipe coming from the straightener is conveyed to a stop aligned with the X-ray gage and is automatically kicked out onto skids. Manually controlled jack-rolls pick up and rotate the pipe at 60 to 120 rpm.

The X-ray equipment consists basically of an X-ray generator, enclosed in ray-proof, shock-proof housing, and a pick-up unit mounted in a probe tube. Both are mounted on a hydraulically operated, manually controlled buggy that is closely aligned with the jack rolls.

The generator radiates an X-ray beam approximately ⅜ in. diam through the steel wall of the pipe. As the probe tube is passed into the open end of the pipe, the pick-up unit receives the X-ray beam and converts it into an electrical signal. This is amplified to actuate an indicating meter and automatic servo-mechanism. This mechanism sprays paint on the outside of the pipe at any point where the wall thickness is less than the predetermined standard for which the instrument has been calibrated.

After the wall thickness is checked on one end, the pipe is conveyed to another X-ray gage at the opposite end of the skids, and the second end is checked in a similar manner.

The forward speed of the buggy is such that the pipe can be checked at the rate of two in. or more of length per second. The probe length is designed to check each pipe end to a maximum length of five ft. Longer probes however, are possible, the governing factor being only the resultant deviation from horizontal due to overhanging weight.

The first experimental X-ray gage of this type ever used for checking wall thickness of seamless steel pipe was installed in the Ambridge plant of Spang-Chalfant in 1950. During the latter part of 1951, additional X-ray gages were installed in the line of production. All of these gages were designed and manufactured by the Industrial Gauges Corp. of Englewood, N. J., who also assisted in developing the method of application and the auxiliary equipment.

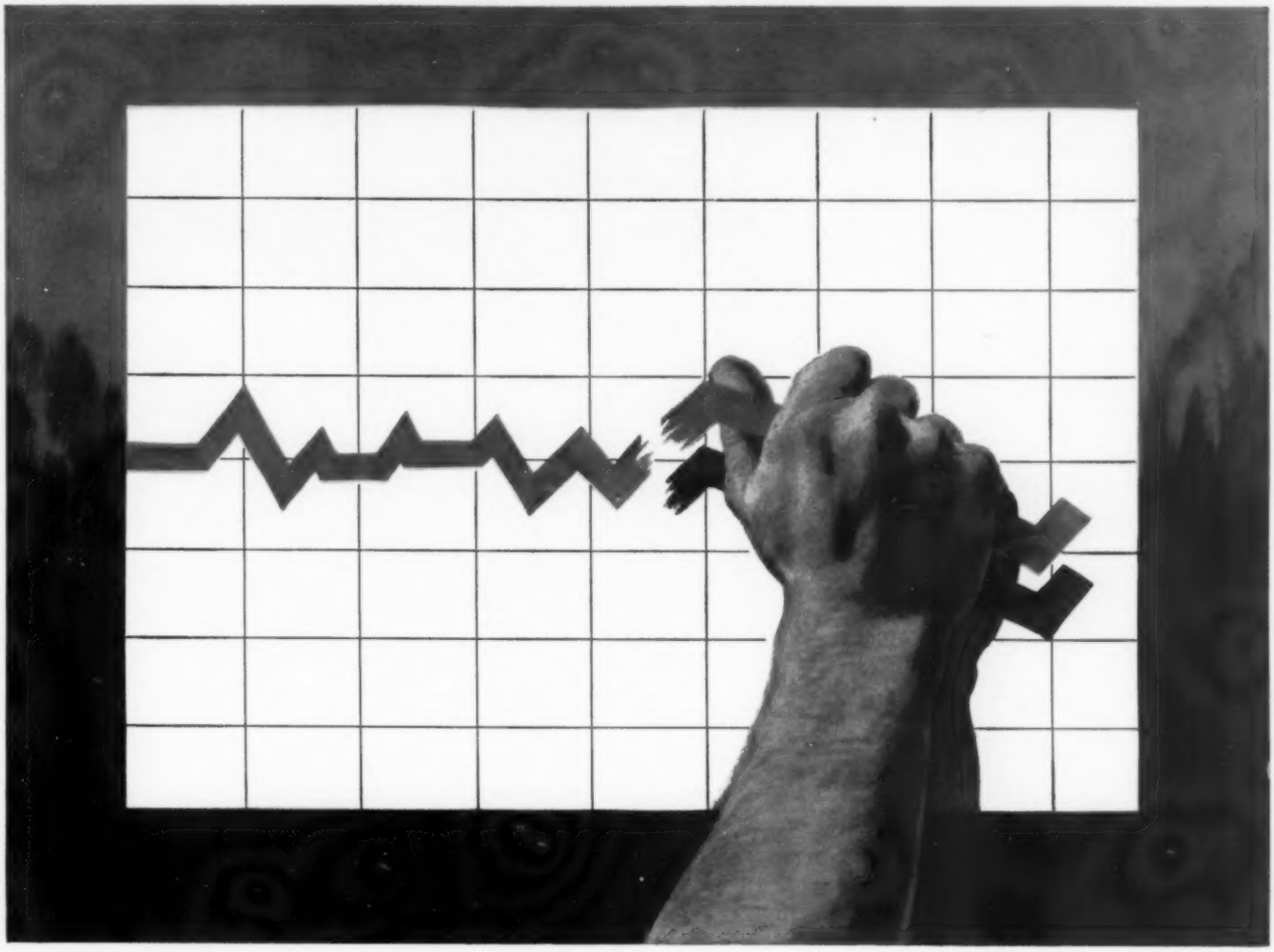
All necessary electrical and X-ray protective measures are incorporated in the gage and it is guaranteed that stray radiation at a distance of two ft in any direction does not exceed 0.060 Roentgen unit per eight hour day as prescribed by the National Bureau of Standards and the American Standards Association.

AID DEFENSE

MORE SCRAP TODAY . . . .
MORE STEEL TOMORROW.

GET IN THE SCRAP TO KEEP STEEL COMING.

NON-FERROUS SCRAP IS NEEDED TOO!



How much tonnage does your down-time steal?

EXCESSIVE down-time for bottom repairs steals precious production time—time when your furnace should be making steel!

You can cut costly repairs, greatly increase your tonnage per year, when you install a bottom of Permanente 165 *periclase* ramming mix.

Bonded by means of crystal-bridging, patented Permanente 165 begins formation of a ceramic bond as low as 1500°F—gives a *deeper bond* at normal burn-in temperatures—with no formation of fluids.

Because Permanente 165 has an MgO content of more than 95% after burn-in, *higher refractoriness* is retained longer under operating conditions. *High density* is insured by accurately-sized, pre-shrunk periclase grains.

This means you get a better bottom that requires less time and materials for repair, with far less danger of costly breakthroughs.

YOUR Kaiser refractory engineer will give prompt attention to your refractory problem—will offer, where desired, research, design and installation service to give you maximum production most economically. Write for descriptive literature on Permanente 165 and on the companion ramming mix, Permanente 84. Principal sales offices: *Chemical Division*, Kaiser Aluminum & Chemical Sales, Inc., 1924 Broadway, Oakland 12, California. First National Tower, Akron 8, Ohio.

Kaiser Chemicals

Pioneers in Modern Basic Refractories

Basic Refractory Brick and Ramming Materials • Dolomite • Magnesia • Magnesite • Alumina • Periclase

They did what you can do to produce more

Weirton's new tinning line is a three-high structure (background). The strip moves up through three decks where it's plated and washed. Reflow takes place as it descends the tower in back of Weirton department superintendent, Harry Reading, and tinplate manager, Al Kadell. Man in foreground runs the whole operation from his master control panel.

The world's fastest tinning lines

This new tinning line of Weirton's is one of the world's fastest. It operates at 2,500 fpm, three times faster than most lines. Yet product quality is excellent. Westinghouse developed a drive with numerous advanced engineering features. See if they give you an idea for your new mills and process lines.

Two things make the high speeds possible: First, Westinghouse RF *radio frequency* heating is used to "reflow" the tin (and produce the shiny surface). Second, a special control system keeps the plating current proportional to line speed and assures uniform thickness. The highly synchronized drive ties the whole complex line together.

The RF heating works so fast it produces an actual "flow line" on the moving strip. An electric eye continuously scans this flow line and uses it to maintain the precisely desired heating rate. Thus despite variations in strip speed, thickness and moisture content, there's no danger of overheating or underflow.

Removing finished coils and adding new ones doesn't stop the line. Extra strip in looping pits provides for slow-speed operation during changes. And the controls prevent any quality variation during the slowdown. The final quality check is a pinhole detector in the trimming line which automatically rejects any imperfect sheets.

Call Westinghouse early on your next project. Integrating these developments into a high-production, high-quality line is one of the trickiest possible drive-engineering problems. And this kind of thinking can be applied to *all* steel mill projects. Call in Westinghouse early on your next job.

J-94910

YOU CAN BE SURE... IF IT'S
Westinghouse

EQUIPMENT FOR
STEEL PRODUCTION

DOWELL SERVICE

CHEMISTRY APPLIED TO MAINTENANCE CLEANING PROBLEMS

Dowell Service cleaned over 600 feet in THREE WORKING DAYS!

Coke oven gas is supplied to a large mid-western strip mill through 30-inch gas mains from the company's coke ovens two miles away. Deposits had accumulated in a 600-foot section of this line until the pressure drop had increased to double that of a clean line. Previous cleaning attempts were unsatisfactory . . . then Dowell Service was called.

With specially designed high-pressure jets and mobile high-pressure pumps, Dowell Service cleaned the dirty section in three working days. *There was no dismantling and Dowell Service did not interfere with the regular function of the gas line!* Trained Dowell engineers planned the job for utmost *safety, speed and economy.*

Boilers, blast furnaces, cooling systems, stoves, water lines, gas washers and many other types of equipment in the steel industry can be effectively cleaned with Dowell Service. Dowell engineers fill or spray the equipment to be cleaned with liquid solvents that are designed to penetrate and clean places inaccessible to other methods. Costly dismantling is eliminated and downtime is shortened.

Backed by tested equipment and experience in many jobs, Dowell engineers will be glad to consult with you on *better, faster* methods of cleaning your industrial equipment. No obligation . . . just call the nearest Dowell office today.

Other recent Dowell jobs:

Mud-like sludges consisting of calcium carbonate, iron oxides and iron sulfide were Dowell-cleaned from a blast furnace gas scrubber in four hours. Result: Pressure drop decreased from 22 to 7 inches of water.

•

The ammonia liquor cooling coils in a coke works became heavily encrusted with iron oxide scale. These deposits were removed by Dowell Service without interrupting operations. Result: A daily savings in coal and steam of $167.28.

•

The checkerworks in a blast furnace stove were 98% clogged with broken tile and fused material. With special high-pressure jet equipment, fast Dowell Service cleaned the checkerwork openings completely.

DOWELL INCORPORATED • TULSA 1, OKLAHOMA

CALL

New York 20	Pittsburgh 19	Ft. Worth 2	Mt. Pleasant, Mich.
Boston 16	Detroit 2	Shreveport 69	Hamilton, Ohio
Philadelphia 2	Chicago 4	Atlanta	Charleston, W. Va.
Baltimore	St. Louis 8	Indianapolis	Salem, Illinois
Wilmington 99	Kansas City 8	Louisville	Beaumont, Texas
Richmond 19	Wichita 2	Upper Montclair, N. J.	Borger, Texas
Jacksonville 2	Oklahoma City 2	Anniston, Alabama	Midland, Texas
Buffalo 2	Houston 2	Hattiesburg, Miss.	Wichita Falls, Texas
Cleveland 13	New Orleans 12	Lafayette, La.	Hobbs, N. Mex.

★ *Maintenance cleaning service for industrial heat exchange equipment.*

★ *Chemical services for oil, gas and water wells.*

DOWELL

A Service Subsidiary of

THE DOW CHEMICAL COMPANY

Date-line Diary...

March 1

▲ DPA announced certificates of necessity for accelerated tax amortization for a number of new projects. Among these certificates, the largest one went to Bethlehem Steel for $38,000,000 for production of coke and pig iron at Sparrows Point; the second largest went to Jones & Laughlin Steel Corp. for coke ovens at an estimated cost of $22,953,300 at Pittsburgh; the sixth largest went to U. S. Steel at Uniontown, Pa. for coal production at an estimated cost of $8,311,385; the ninth largest went to Sharon Steel Corp. at Fairmont, West Virginia for the production of pig iron at an estimated cost of $5,522,000.

▲ Mesta Machine Co. reported net income of $3,808,194 or $3.81 per share for 1951. This compares with net income of $5.60 a share in 1950. Backlog at the end of the year was $59,500,000.

▲ NPA made available an additional 70,000 tons of structural steel for commercial and industrial construction in the second quarter.

March 3

▲ Copperweld Steel Co. is asking stockholders to approve triple its present authorized indebtedness raising the present limit from $5,000,000 to $15,000,000.

▲ According to the AISI, the operating rate for the steel industry for the week beginning March 3 is scheduled at 101.3 per cent of capacity. This is equivalent to 2,104,000 tons compared with 2,096,000 tons one week ago. This will be the largest amount ever to be made in a week in the United States.

March 4

▲ NPA ended restrictions on the use of lead and now allows consumers to increase inventories from thirty to a sixty day supply.

▲ Westinghouse Electric Corp. reported net income for 1951 of $64,578,000 or $4.03 a share after payment of dividends on preferred stock. This compares with $5.36 the previous year. Net sales in 1951 totaled $1,240,801,000 compared with $1,019,923,000 the year before. The company also reported that it will build a complete power plant for the world's first atomic-powered submarine.

▲ DPA boosted metal allocations to civilian industry for the second quarter by 30,000,000 lb of aluminum and 25,000,000 lb of copper.

March 5

▲ It was announced that construction on Iowa's first steel plant will start this month. This plant will be in operation within one year and is being built for the North American Steel Co. Initial production will be iron and coke.

▲ Reserve Mining Co. announced that it will expand its taconite beneficiation program at Beaver Bay by 50 per cent to reach an annual capacity of 3,750,000 tons.

March 7

▲ Crucible Steel Co. reported record sales in 1951 of $202,869,000. Net income after taxes and debt charges totaled $8,363,000 or $11.89 a share, compared with $8.28 a share in 1950.

▲ General Electric Co. reported net sales in 1951 of $2,319,348,000 and net earnings of $138,117,000. This is equivalent to $4.79 a share compared with $6.01 a share in 1950.

▲ Kaiser Steel Corp. is starting a $65,000,000 expansion program which will provide for construction of a third blast furnace and which will provide for a ninth open hearth and other facilities.

▲ Globe Iron Co. of Jackson, Ohio will start construction of a $2,000,000 ferro alloy plant on the Muskegon River north of Beverly, Ohio.

March 8

▲ Sharon Steel Corp. is shutting down two open hearth furnaces at Farrell, Pa. because of poor market conditions.

▲ Yolo Steel and Metal Corp. received certificate of necessity from the DPA which will permit it to write off in five years 85 per cent of $44,000,000, which will be spent for blast furnace and coke oven facilities. Steel mill portion of this program is scheduled for later.

▲ Corps of Engineers states that ten large ocean freighters will take the New Orleans to Chicago trip to join the lake fleet. Three of these must be cut in two in order to make the trip.

March 10

▲ American Railway Car Institute announced that February deliveries of new freight cars totaled 7358. Orders during March totaled 6120 leaving a backlog on March 1 of 118,900.

▲ U. S. Steel announced that about 500,000 tons of Great Lakes ore will be shipped over the Great Lakes to Conneaut and thence by rail to Morrisville, Pa. to the Fairless works.

▲ AISI announced that total payroll for the iron and steel industry in January set a record of $252,236,000. Employment in the month was 672,100, with an average of 41.4 hr per week. Wage earners averaged $1.958 an hr.

March 11

▲ Aluminum Association reports that production of primary aluminum in January totaled 153,867,619 lb.

▲ U. S. District Judge Watson refused to grant a special hearing to Bethlehem Steel Co. to determine value of Williamsport Wire Rope Co.

March 12

▲ F. W. Dodge Corp. reports construction contracts awarded in the thirty-seven states east of the Rockies during February totaled $885,206,000.

March 13

▲ New Jersey state geologist reported that iron mines in northern New Jersey produced more ore of shipping grade in 1951 than any year since 1940, with approximately 645,700 gr tons of ore.

▲ Pittsburgh Steel Co. reported record net earnings in 1951 of $7,331,599. Earnings per share dripped to $5.99 from $6.13 in 1950. Total sales were $149,255,271.

March 14

▲ Superior Steel Corp. reported record 1951 sales of $27,984,051, and net earnings of $1,177,480, or $4.20 a share.

▲ General Motors Corp. sales dropped in 1951 for the first time since 1946. Total sales were $7,465,554,851. Net income before preferred dividends totaled $506,199,560 or $5.63 a share compared with $9.35 a share in 1950.

▲ Jones & Laughlin Steel Corp. reported sales of $564,330,000 for 1951 with a net income of $30,998,000 or $4.76 a share. Net income in 1951 totaled $39,744,000.

March 15

▲ United Engineering and Foundry Co. reported net sales in 1951 of $67,388,758, a new high. Net income totaled $3,845,710 or $4.62 a share compared with $6.39 a share in 1950. Total backlog at the end of the year was $111,000,000, or almost double the $62,600,000 at the start of 1951.

March 17

▲ The AISI reports that the operating rate of the steel industry beginning March 17 is scheduled at 102.4 per cent of capacity. This is equivalent to 2,127,000 tons compared with 2,114,000 tons one week ago. This is a new record.

▲ Republic Steel Corp. is borrowing $30,000,000 from a group of unidentified investors.

▲ Jones & Laughlin Steel Corp. completed a $20,000,000 credit arrangement with a group of ten banks headed by the Mellon National Bank & Trust Co.

March 18

▲ International Nickel Co. of Canada reported net earnings of $62,875,571 in 1951 or $4.17 a share compared with $3.21 a share in 1950. Total sales in 1951 were $286,785,241.

March 19

▲ United States Steel Corp. reported total sales in 1951 of $3,524,121,226. Income after taxes etc. totaled $184,359,787, or $6.10 a share compared with $7.29 a share in 1950.

▲ Alcoa reported consolidated net income for 1951 of $39,301,308 or $7.53 a share.

March 20

▲ Indonesian government agreed to accept the U.S. offer of $1.18 a lb for tin produced in that country.

▲ Allegheny Ludlum Steel Corp. reported earnings in 1951 of $8,834,140 or $5.40 a share. Total sales were $229,090,000.

▲ Allis-Chalmers Manufacturing Co. reported profits for 1951 of $22,416,813 or $8.19 a share compared with $8.72 a share in 1950. Total sales in 1951 were $457,060,766. Order backlog at the end of 1951 totaled $390,154,308.

March 22

▲ General Refractories Co. reported sales in 1951 of $55,273,322. Net earnings totaled $3,960,584 or $8.42 a share compared with $7.48 a share in 1950.

March 24

▲ Steel production for the week beginning March 24, 1952 is scheduled at 102.6 per cent of capacity. This is equivalent to 2,131,000 tons compared with 2,127,000 one week ago.

▲ The Bureau of Mines reports that natural gas marketed in the United States in 1951 totaled 7,415,600,000,000 cu ft. This exceeds the amount in 1950 by 18 per cent. Consumption for the year in the Middle Atlantic region increased 55 per cent.

March 25

▲ American Institute of Steel Construction reported total bookings of fabricated structural steel in February of 202,810 tons. Shipments totaled 248,443 tons. Backlog as of March 1 totaled 2,408,032 tons.

March 27

▲ The Bureau of Mines reported that iron ore production in the United States in 1951 totaled 116,430,000 gr tons compared with 98,045,360 gr tons in 1950. Stocks of ore and sinter held by consumers were reduced 11 per cent to 44,838,451 gr tons at the end of the year. Mine stock increased 12 per cent to 5,793,713 tons.

▲ National Steel Corp. reported net earnings for 1951 of $45,287,093 or $6.15 a share compared with $7.85 a share in 1950. Total sales were $618,461,408.

March 28

▲ Belgian tin producers accepted United States government's offer of $1.18 a lb for their tin. This will be a two year contract.

March 30

▲ Defense Mobilizer Charles E. Wilson resigned because of a disagreement over steel prices.

March 31

▲ Inland Steel Co. reports net income for 1951 of $34,398,585 or $7.02 a share compared with $7.76 a share in 1950. Sales totaled an all time record $518,684,618.

▲ CIO steelworkers announced a tentative agreement had been reached with Kaiser Steel Corp. on a new wage contract. It is believed the steelworkers get most of the items proposed by the Wage Stabilization Board.

▲ Census Bureau states that unemployment in March dropped to lowest level for the month since World War II.

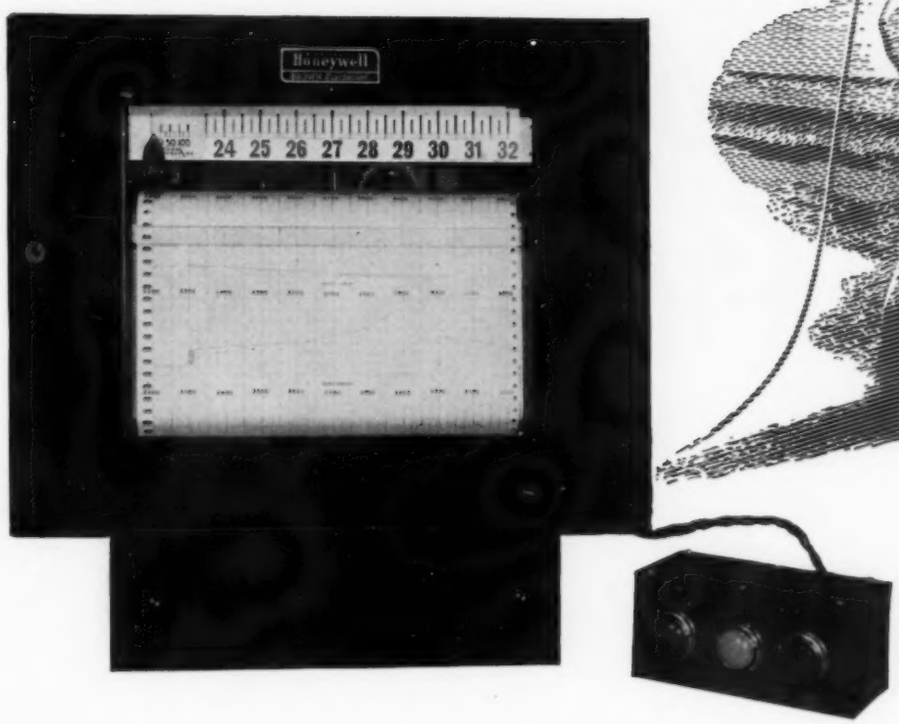
▲ Republic Steel Corp. reported record sales in 1951 of $1,060,371,877 and net income of $54,921,541 or $9.03 a share compared with $10.53 in 1950.

▲ According to the AISI, the operating rate of the steel industry beginning March 31 is scheduled at 102.1 per cent of capacity. This is equivalent to 2,120,000 tons of steel ingots and castings compared with 2,131,000 one week ago.

▲ Acme Steel Co. reports record sales in 1951 of $81,292,814 or 18 per cent above 1950. Net earnings were $6,865,555 or $3.32 a share compared with $3.45 a share in 1950.

New signalling system

simplifies bath temperature recording



NEW automatic signalling features incorporated in the *ElectroniK* Recorder now bring added simplicity and economy to immersion thermocouple measurements of steel bath temperatures. Integral signalling circuits in the recorder actuate remote color-coded lights near the furnace to tell the operator when:

. . . thermocouple is properly connected and in operating condition.

. . . instrument is standardized and ready to record.

. . . thermocouple is preheated to correct temperature.

. . . recorder pen has reached actual bath temperature.

The operator can make a complete measurement on signalled information alone . . . doesn't need to consult the *ElectroniK* Recorder, which can be located remote from the furnace.

Thermocouples last longer, too. The operator leaves the couple in the furnace only long enough to get an accurate reading . . . removes it the instant that the signal tells him the measurement is completed.

Whether you make measurements in a spoon or directly in the bath, the *ElectroniK* Recorder's signalling features can appreciably speed readings and insure consistent accuracy.

For a discussion of how this recorder and signal system can improve bath measurements in your shop, call in our local engineering representative . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4464 Wayne Ave., Philadelphia 44, Pa.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

● *Important Reference Data*

WRITE FOR INSTRUMENTATION DATA SHEET NO. 6.4-8a.

Another large synchronous motor by ELLIOTT

● The stator is over eighteen feet high—and yet the air gap between rotor and stator in this huge motor is held to one-eighth inch! That's precision manufacture, as applied in Elliott-built electrical equipment, with all dimensions tailored to a real fit by Elliott "Fabri-Steel" welding technique.

This particular motor is destined for driving the main rolling mill at a big tube mill. It has 294 stator coils, 112 poles, is rated 2000 hp, 64 rpm and develops a pull-out torque of 570,500 lb-ft.

Big motors like this are an Elliott specialty. Why not check?

ELLIOTT Company

Ridgway Division
RIDGWAY, PA.

Plants at: JEANNETTE, PA. • RIDGWAY, PA.
AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES

R2-13

Industry News...

LA BELLE WORKS OF WHEELING STEEL CELEBRATES 100TH ANNIVERSARY

▲ This month marks the 100th Anniversary of Wheeling Steel Corp.'s LaBelle works, Wheeling, W. Va., the largest cut nail plant in the United States. From its beginnings in 1852, historic LaBelle works has grown steadily, and nail makers in Wheeling are confident that the cut nail will be in demand by the building industry for many more years to come.

The cut nail has a long and colorful history. It was in 1808 that the first factory for hand forging cut nails from iron was built at Steubenville, Ohio—24 miles north of Wheeling, W. Va. During the next 30 years several small plants making hand-forged nails sprang up along the Ohio River.

Nails were a luxury in the pioneer days of this section of the country, gradually replacing traditional building techniques dependent on mortise and tenon and hardwood pegs.

Between 1847 and 1883 many nail mills emerged on the banks of the Ohio. These mills, of which Wheeling's LaBelle works is one, used hand-fed machines for the first "mass production" of cut nails, and gave the name "Nail City" to Wheeling.

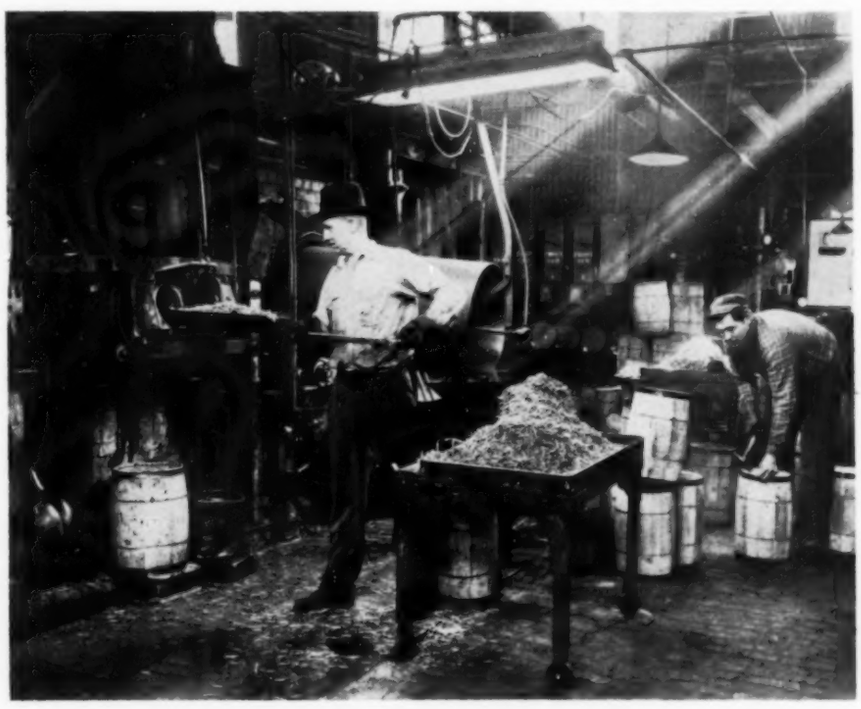
All the hand-fed nail machines in those early plants made nails by cutting wrought or puddled iron. In the late 1870's bessemer steel came into vogue for nail-making and was universally adopted because of the economies it offered. Today's cut nails are made on self-feeding machinery, from open hearth steel plate.

A strike among nailers that started in 1885, over wage differentials between the clannish nailers and their helpers, was not settled until 13 months later. It was during this strike standstill in the cut nail industry that the wire nail—scarcely a factor up to that time—began to make inroads and, for a long time, threatened the cut nail industry.

But the cut nail has retained its historic importance in the construction industry. With four sides and four square edges along its tapered shank, it cuts its way into hard wood without splitting it. Given a carefully controlled hardness by tempering, the cut nail drives through hard wood without bending, thus saving carpenters time and grief. Because of superior holding power, 100 cut nails do the work of 172 wire nails.

Throughout the long history of cut nails "Nail City" craftsmen have refused to compromise on quality of workmanship or product. The same high standards are maintained today, with automatic nail-making machinery, as were employed a century ago in the hand process.

Hand-fed machines are still in use at this century-old cut nail plant.



ANNOUNCE PILOT PLANT FOR TACONITE PELLETS

▲ Allis-Chalmers Manufacturing Co. has announced plans for a $75,000 pilot plant for pelletizing and heat hardening taconite concentrates. The announcement was disclosed in a paper by G. V. Woody, "Heat Hardening of Taconite Pellets," presented at the annual Blast Furnace, Coke Oven, and Raw Materials Conference of the AIMME in Pittsburgh, Pa., March 31.

Warning that a great deal of testing remains to be done before the commercial feasibility of continuous heat hardening of tanconite pellets can be determined, Mr. Woody pointed out that the pilot plant, a cooperative undertaking with Arthur G. McKee Co. of Cleveland, Ohio, is the only way to make certain that successful laboratory results will be borne out in practice.

The plant, being built at Carrollville, Wisc., 14 miles south of Milwaukee, is expected to process one to two tons per hour of concentrated taconite fines brought in by rail from the Mesabi Range.

Pelletizing will be done in a balling drum and the "green" (soft) pellets predried in a rotating drum prior to being fed to the traveling grate. During the travel on the grate, the green pellets will be further dried, preheated, ignited, and burned. Waste heat from the grate is utilized in the drying

AMERICAN CHEMICAL PAINT COMPANY
AMBLER CHEMICALS ACP PROCESSES PENNA.

Technical Service Data Sheet
Subject: CHARACTERISTICS OF AND USES FOR RODINE®

A. SULFURIC ACID PICKLING

TYPE OF RODINE	POWDERED	POWDERED	POWDERED	LIQUID	LIQUID	LIQUID	LIQUID
FOAMING OR NON-FOAMING	FOAMING	NON-FOAMING	NON-FOAMING	FOAMING	NON-FOAMING	NON-FOAMING	NON-FOAMING
WITH WHAT ACID USED	SULPHURIC ONLY	SULPHURIC ONLY	SULPHURIC ONLY	SULPHURIC OR MURIATIC MIXTURES CONTAINING WEAK NITRIC	SULPHURIC MURIATIC	SULPHURIC PHOSPHORIC HYDROFLUORIC	SULPHURIC ONLY
WITH WHAT STRENGTH ACID	ANY PICKLING STRENGTH	ANY PICKLING STRENGTH	ANY PICKLING STRENGTH	ANY PICKLING STRENGTH	ANY PICKLING STRENGTH	ANY PICKLING STRENGTH	ANY PICKLING STRENGTH
TEMPERATURE LIMITATIONS	ANY PICKLING TEMPERATURE	ANY PICKLING TEMPERATURE	ANY PICKLING TEMPERATURE GOOD IN HOT ACID	PREFERABLY HOT OVER 180°F	ANY PICKLING TEMPERATURE GOOD IN HOT ACID	ANY PICKLING TEMPERATURE FAIR IN HOT ACID	ANY PICKLING TEMPERATURE GOOD IN HOT ACID
SOLUBILITY	PARTLY SOLUBLE READILY DISPERSED	PARTLY SOLUBLE READILY DISPERSED	PARTLY SOLUBLE READILY DISPERSED	SOLUBLE	MEDIUM READILY DISPERSED IN HOT ACID BATH	SOLUBLE	MEDIUM READILY DISPERSED IN HOT ACID
BEST SUITED TO TYPE OF STEEL	UNREACTIVE STEELS-O.H.STEELS-SHEETS-TIN PLATE-	UNREACTIVE STEELS O.H.STEELS-SHEETS TIN PLATE	REACTIVE OR UNREACTIVE STEELS O.H.OR BESSEMER SIMPLE OR ALLOY LOW OR HIGH CARBON	UNREACTIVE STEELS O.H.STEELS STAINLESS STEELS	REACTIVE STEELS ALLOY AND H.C. ALSO O.H.AND UNREACTIVE STEELS	ANY TYPE STEEL	REACTIVE STEELS ALLOY AND H.C. ALSO O.H.AND UNREACTIVE STEELS
OUTSTANDING USES	FAST PICKLING TIN PLATE WHITE PICKLER.	FAST PICKLING. TIN PLATE WHITE PICKLER	FAST OR SLOW PICKLING TUBE AND PIPE ALLOY STEELS	FAST PICKLING. STAINLESS STEELS IN BATH CONTAINING WEAK NITRIC ACID	USED WITH SALT IN SULPHURIC PICKLE, CAN BE ADDED TO CONCENTRATED ACID	PICKLING FOR PLATING OR WHERE A SOLUBLE INHIBITOR IS INDICATED	USED WITH SALT IN SULPHURIC
USUAL PROPORTION FOR PICKLING	25% TO 33% B.H.OF SULPHURIC ACID	25% TO 33% B.H.OF SULPHURIC ACID	25% TO 50% B.H.OF SULPHURIC ACID	1/2 TO 1% B.H.OF SULPHURIC ACID	1/4 TO 1% B.H.OF SULPHURIC ACID	1/4 TO 1% B.H.OF SULPHURIC ACID	1/4 TO 1% B.H.OF SULPHURIC ACID
MISCELLANEOUS COMMENTS	WHEN ADDED CONTINUOUSLY MIX IN A THIN SLURRY OF DILUTE SULPHURIC ACID	WHEN ADDED CONTINUOUSLY MIX IN A THIN SLURRY OF DILUTE SULPHURIC ACID	ADD IN A SLURRY OF WATER OR ADD DIRECT TO BATH AFTER IT REACHES PICKLING TEMPERATURE	FORMS A HEAVY FOAM BLANKET	ADD DIRECT TO BATH AFTER IT REACHES PICKLING TEMPERATURE	CAN BE ADDED TO WARM OR COOL PICKLE BATHS	ADD TO BATH AFTER IT REACHES PICKLING TEMPERATURE
EFFECTIVENESS COMPARED WITH OTHER RODINES	MEDIUM	MEDIUM	STRONG	MEDIUM	STRONG	MEDIUM	STRONG

B. MURIATIC ACID PICKLING

TYPE OF RODINE	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID
FOAMING OR NON-FOAMING	FOAMING	NON-FOAMING TO SEMI-FOAMING	NON-FOAMING	NON-FOAMING TO SEMI-FOAMING	NON-FOAMING
WITH WHAT ACID USED	MURIATIC AND SULPHURIC MIXTURES CONTAINING WEAK NITRIC	MURIATIC	MURIATIC	MURIATIC	MURIATIC
WITH WHAT STRENGTH ACID	ANY PICKLING STRENGTH	ANY PICKLING STRENGTH	ANY PICKLING STRENGTH	30% TO UNDILUTED	30% TO UNDILUTED
TEMPERATURE LIMITATIONS	ANY PICKLING TEMPERATURE	COLD OR HOT GOOD IN HOT BATHS	LESS THAN 150° FAHR	FROM 100° FAHR UP	LESS THAN 120° FAHR
SOLUBILITY	FAIR	GOOD	GOOD	GOOD	GOOD
BEST SUITED TO TYPE OF STEEL	ANY	ANY	ANY	ANY	ANY
OUTSTANDING USES	WHERE A FOAM IS REQUIRED ON MURIATIC ACID BATHS	PICKLING. REMOVING LIME SCALE FROM EQUIPMENT IN WEAK MURIATIC SOLUTION	PICKLING IN WARM WEAK MURIATIC ACID PICKLING FOR PLATING	CLEANING OIL WELLS OR EQUIPMENT IN STRONG HEATED SOLUTIONS	CLEANING IN COOL STRONG MURIATIC SOLUTIONS
USUAL PROPORTION FOR PICKLING	1/8 TO 1/3% B.V. COMMERCIAL MURIATIC ACID	1/8 TO 1/2% FOR PICKLING. 2 TO 3% FOR CLEANING EQUIPMENT	1/8 TO 1/2% FOR PICKLING	1/8 TO 2% B.V. COMMERCIAL MURIATIC ACID	2 TO 3% B.V. COMMERCIAL MURIATIC ACID
MISCELLANEOUS COMMENTS	OTHER GRADES BETTER FOR CLEANING EQUIPMENT	CAN BE ADDED TO UNDILUTED MURIATIC ACID TO BE DILUTED	CAN BE ADDED TO UNDILUTED MURIATIC ACID TO BE DILUTED	WILL PLATE COPPER ON WORK IF USED IN WEAKER MURIATIC SOLUTIONS	WILL PLATE COPPER ON WORK IF USED IN WEAKER MURIATIC SOLUTIONS
EFFECTIVENESS COMPARED WITH OTHER RODINES	MEDIUM	MEDIUM	MEDIUM	STRONG	STRONG

C. SPECIAL APPLICATIONS

"Rodine" is effective in pickling iron-nickel alloys and alloys containing both nickel and cobalt, in muriatic acid, or in sulfuric acid containing 1% to 2% of muriatic acid. It is also used in the pickling of white metals, alloys of copper, nickel, etc. Special grades of "Rodine" are available for the spray pickling of magnesium sheets in sulfuric acid.

CHEMICALS ACP PROCESSES • WRITE FOR DESCRIPTIVE FOLDER ON "RODINE" AND INFORMATION ON YOUR OWN PICKLING PROBLEM. CHEMICALS ACP PROCESSES

and preheating stages to reduce fuel consumption.

The pilot mill will also permit further study of such problems as heat hardening of both magnetite and hematite concentrates without admixed carbon, according to Mr. Woody.

It is planned that the product from the unit will be shipped to a blast furnace for test in actual iron production.

J & L INSTALLS COAL BARGE UNLOADER

▲ What is claimed to be the world's fastest coal barge unloader recently began operations at the coke plant of Jones & Laughlin's Aliquippa, Pa., works. This giant machine is part of the new coal handling facilities designed, fabricated and erected for J & L by Heyl & Patterson, Inc.

Designed specifically for this operation, this modern barge unloader, with an average unloading capacity of 1350 tons of coal per hour, contains several unique features besides its unloading speed that help make it the most efficient coal barge unloader in use today.

Coal is unloaded from the barge by means of a coal hoist consisting of an 83-ft long, bucket-type elevator. As the loaded barge is moved slowly past the coal hoist, each of the continually-moving elevator buckets takes a ½ ton bite from the coal pile and carries it to the top of the unloader where it is dropped through a coal crusher and on to a conveyor.

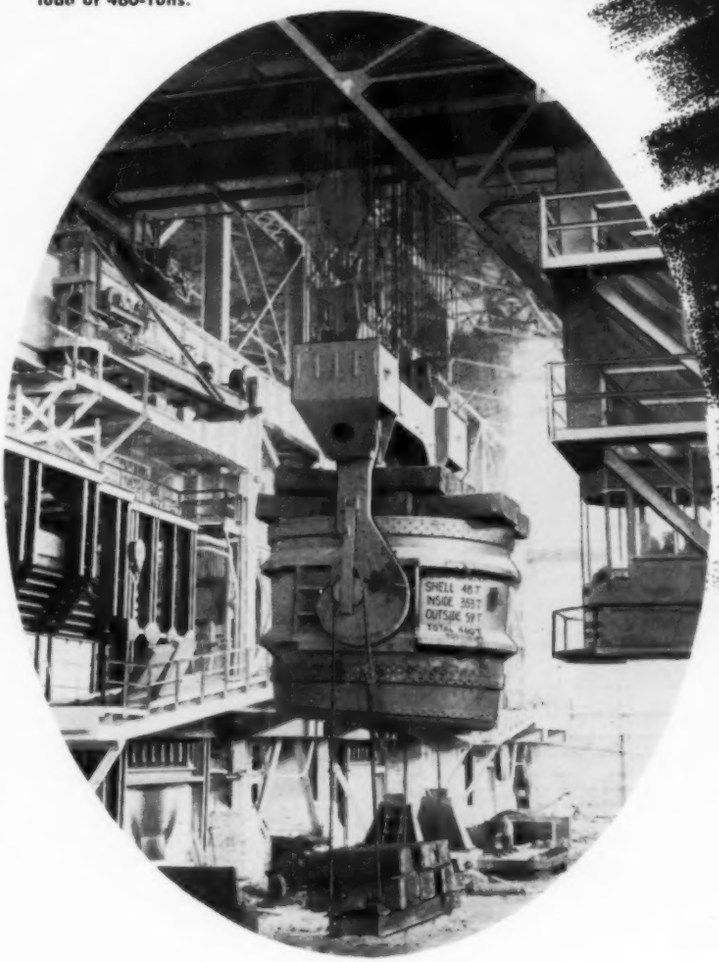
Only three passes of the barge are necessary for complete unloading.

A special feature of the coal hoist is that it can be raised or lowered 38 ft to allow a barge to pass underneath or to compensate for the height of the river and the height of the barge when unloading. The coal hoist can operate equally well from any height.

The barge is kept in the unloading position by snubbing lines to prevent drifting away from the dock and by three Heyl & Patterson "barge positioners" which keep the barge from drifting into the dock. These "barge positioners" fit into the face of the dock and operate like huge doors, pivoting out from the dock as much as five feet to contact the barge. Each of the three positioners is capable of independent movement which enables the operator to keep the barge in exactly the right position at all times.

SAFE Crane Control

New 300-Ton ladle crane with EC&M Control successfully handling a test load of 460-Tons.



New dynamic lowering circuits for d-c crane-hoists come and go—are superseded by other new circuits, but the well-known EC&M Wright Dynamic Lowering Circuit Hoist Controller continues to be first choice for industrial cranes.

Quick brake-release and fast-operating LINE-ARC Contactors permit accurate spotting of heavy loads—resulting in fewer inching movements, which maintenance men recognize as a contributing factor to reduced upkeep.

Also important is that the operator has direct control (from the Master Switch) of all loads in the lowering direction. The EC&M Wright Circuit is SAFE.

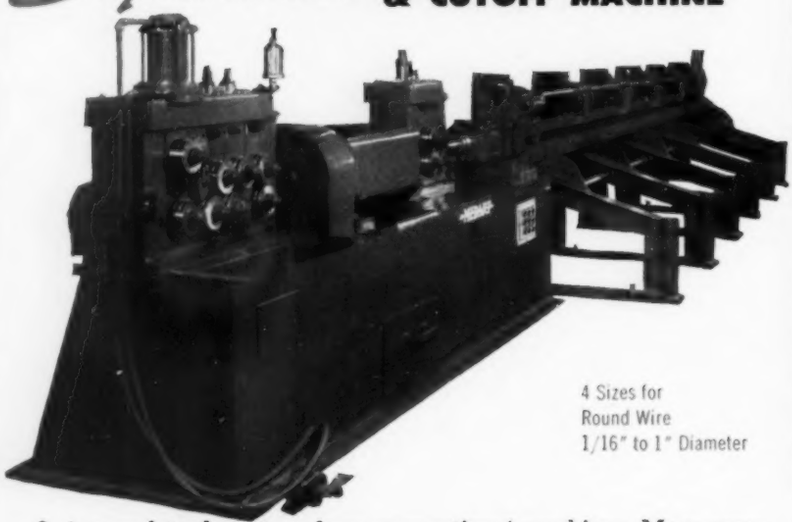
When Buying Cranes It Pays To Specify E&M Control

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET • CLEVELAND 4, OHIO

A New & Different Fully Automatic Wire Straightener!

MEDART

Supermatic WIRE STRAIGHTENING & CUTOFF MACHINE



4 Sizes for
Round Wire
1/16" to 1" Diameter

- A complete departure from conventional machines. More compact and accurate, with throughput speeds to 200 f.p.m. depending upon size and type of material.
- Fully automatic feed-through, straightening and cutoff, without attention from operator, after end of coil is started through pinch rolls.
- All swelling or expansion of workpiece is prevented by new HYDRA-ELECTRIC AUTOMATIC CUTOFF. Electronic self-actuating shear eliminates all mechanical operating parts beyond Cutoff. Makes up to 60 cuts per minute.
- Exclusive ROTO-DIE SPINNER is equipped with cylindrical straightening dies mounted in anti-friction bearing, instead of ordinary cast iron shoe-type dies. Virtually all friction, heat and rapid die wear are prevented. Protects against changes in physical characteristics and surface of wire.
- Automatic scale removal from hot-rolled stock.
- Rugged construction. Timken bearings throughout. Ground and polished Smavroc steel rolls. All mechanism completely accessible for maintenance.

Supermatic fully automatic two-plane models for wire shapes other than round also available.

Write For Brochure

THE MEDART COMPANY 3535 DE KALB STREET ST. LOUIS 18, MISSOURI

An 83-ft. long, bucket elevator is used in unloading coal barges.

This results in such complete unloading that no clean-up men are needed in the barge at any time.

The "barge positioners" are also used to push the barge away from the dock after unloading, with no help from a tug-boat.

The movement of the barge while being unloaded is controlled by two barge-haul engines, one for forward movement and one for backward movement. This enables the operator to move the barge with the necessary speed and to keep it perfectly aligned.

The movements of the barge itself, the coal hoist, the elevator and the "barge positioners" are all controlled from the operator's cab.

At the top of the hoist the coal passes through a coal crusher and is transferred to a conveyor. A reversible belt shuttle conveyor then receives the coal and deflects it into one of four 500-ton surge bins where the coal can be stored until needed. From the surge bins the coal is delivered, by another conveyor system, for further processing and then to the coke ovens.

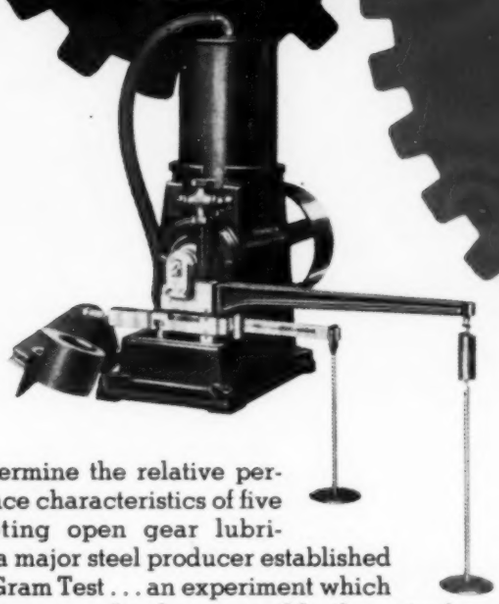
LEWIS TO BUILD FRENCH ROD MILL

▲ Lewis Foundry & Machine Division of Blaw-Knox Co. has received a contract from De Wendel & Co. for a large combination rod and merchant mill to be installed at Joef, near Metz, France. De Wendel is one of the

INDEPENDENTLY CONDUCTED

4-GRAM TEST

—PROVES LEADOLENE Klingfast BEST FOR LUBRICATING OPEN GEARS



To determine the relative performance characteristics of five competing open gear lubricants, a major steel producer established the 4-Gram Test . . . an experiment which reproduces as closely as possible the actual service conditions encountered in open gear and sleeve bearing lubrication.

In this test the Timken Testing Machine, recognized as standard equipment for testing lubricants, was modified slightly to reproduce more precisely actual service conditions. The hardened and ground steel block and cup, indicated at right, normally is under constant lubrication. However, in the 4-Gram Test the flow of lubrication was cut off and 4 grams of the lubricant being tested were applied at room temperature. The machine then was set in motion and watched closely for signs of scoring.

Five lubricants, all accepted in industry as "good quality," were tested. *Results of the test showed that LEADOLENE KLINGFAST gave over 3½ times the service of the next best lubricant and up to 6 times the service of the other lubricants tested.*

Since open gears are lubricated periodically and not constantly, the pH-ilm must have lasting characteristics. Thus, this test is truly representative of actual field operation tests for open gears. The enduring action together with extremely high pH-ilm strength guarantee the machine actual lubrication and protection.

In testing . . . and more important, in actual service . . . LEADOLENE KLINGFAST regularly gives comparable performances. A product of 76 years of manufacturing experience, it is a lead-based lubricant with an "Indestructible pH-ilm," capable of withstanding pressures up to 50,000 psi. With LEADOLENE KLINGFAST you profit in two ways: from lowered lubrication costs due to less frequent application, and from greater service life from the machinery being lubricated.

Write for technical data or samples for your own testing.

THE BROOKS OIL CO.

Since 1876

Executive Offices and Plant.....CLEVELAND, OHIO
Executive Sales Offices.....PITTSBURGH, PA.
Canadian Offices and Plant.....HAMILTON, ONTARIO
Cuban Office.....SANTIAGO de CUBA

Results OF 4-GRAM TEST

LEADOLENE KLINGFAST 30 MINUTES without scoring or failing.

LUBRICANT "A" 5 MINUTES A high grade compound scored at 5 minutes and failed in 12 minutes.

LUBRICANT "B" 8 MINUTES A reputable lubricant of residual nature scored and failed in 8 minutes.

LUBRICANT "C" 6 MINUTES A good lead compounded extreme pressure lubricant scored and failed in 6 minutes.

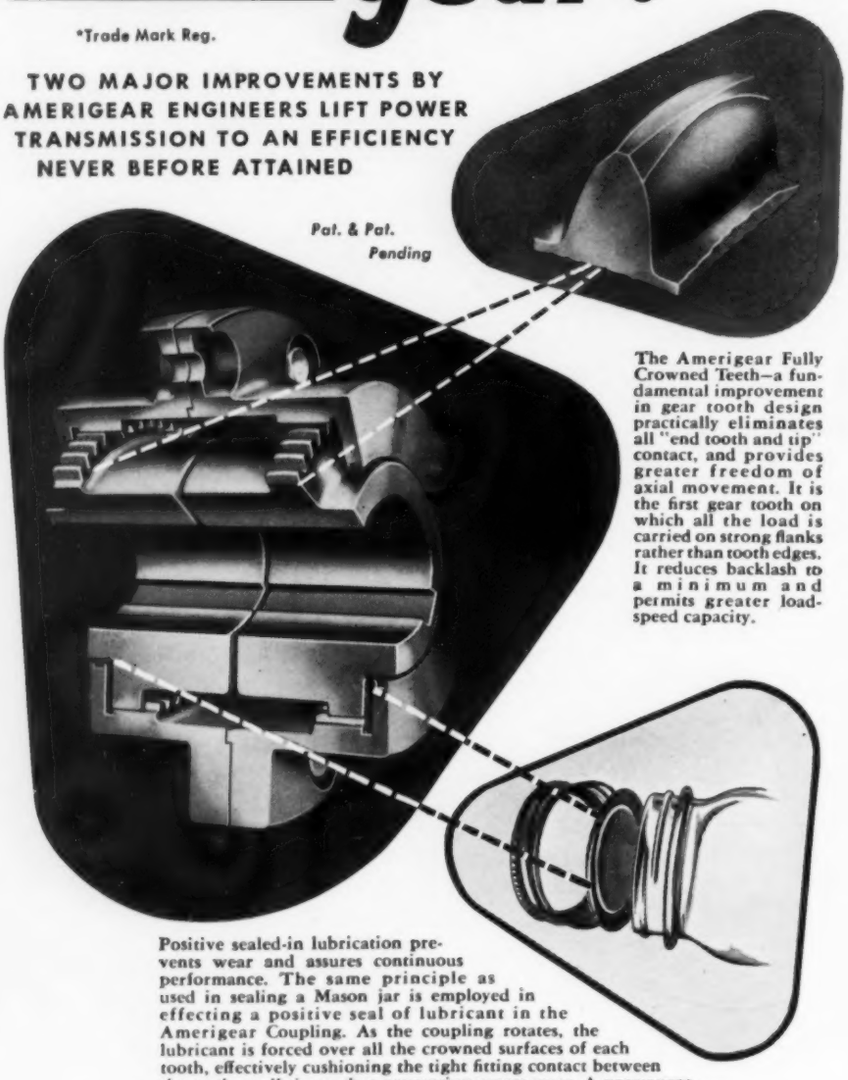
LUBRICANT "D" 6 MINUTES A lead-compounded lubricant scored and failed in 6 minutes.

Coupling-of-the-year!

Amerigear*!

*Trade Mark Reg.

TWO MAJOR IMPROVEMENTS BY AMERIGEAR ENGINEERS LIFT POWER TRANSMISSION TO AN EFFICIENCY NEVER BEFORE ATTAINED



Pat. & Pat. Pending

The Amerigear Fully Crowned Teeth—a fundamental improvement in gear tooth design practically eliminates all "end tooth and tip" contact, and provides greater freedom of axial movement. It is the first gear tooth on which all the load is carried on strong flanks rather than tooth edges. It reduces backlash to a minimum and permits greater load-speed capacity.

Positive sealed-in lubrication prevents wear and assures continuous performance. The same principle as used in sealing a Mason jar is employed in effecting a positive seal of lubricant in the Amerigear Coupling. As the coupling rotates, the lubricant is forced over all the crowned surfaces of each tooth, effectively cushioning the tight fitting contact between the teeth at all times, thus preventing excess wear. A permanent film of lubricant is maintained by centrifugal force between the load-carrying surfaces, even during frequent and sudden reversal.

These two features can mark the beginning of a new era in power transmission for you. Write for folder on Amerigear Fully Crowned Teeth or consult an Amerigear Engineer for more details.

Exclusive territories on these couplings available. Write, wire or phone for details.

AMERICAN FLEXIBLE COUPLING COMPANY

Originator of the Amerigear Fully Crowned Tooth • Sales Offices in Principal Industrial Centers

AFFILIATE OF J. A. ZURN MFG. CO., ERIE PA., U.S.A.

Please send me further information regarding AMERIGEAR COUPLINGS with the Fully Crowned Teeth and Catalog No. 501.

Name ..... *Title* .....

Company .....

Address .....

City ..... *State* .....

Please attach to your business letterhead. Dept. ISE

largest integrated steel producers in France.

The order, exclusive of spares, electrical equipment, and cooling bed, amounts to more than $2,000,000.

To meet the requirements, Lewis is supplying a 31-stand mill of advanced design. It will combine a wide size range with high delivery speed and the ability to roll to one-half and one-quarter commercial tolerances upon demand.

The mill will roll four strands when rolling rods for the coilers, and two strands when rolling rounds for merchant bars. The size range will be 5 to 25 mm diam (.197 in. to .984 in.). It is reported that the rolling speed of up to 5000 fpm will be sustained throughout the life of the rolls. This fast speed will give the mill an estimated capacity of at least 300,000 tons per year.

There will be 11 roughing stands with seven 16 in. × 44 in. mills and four 14 in. × 36 in. mills; eight intermediate stands, all 12 in. × 30 in. mills; and 12 finishers, 10½ in. × 16 in. mills. The motor drive units will be mainly dual stand units with individual drive for each group. Motors will be electronically regulated with low impact drop features and fast recovery, combined with mechanical pre-set loop formation between stands, to prevent stretching or distortion of the bar.

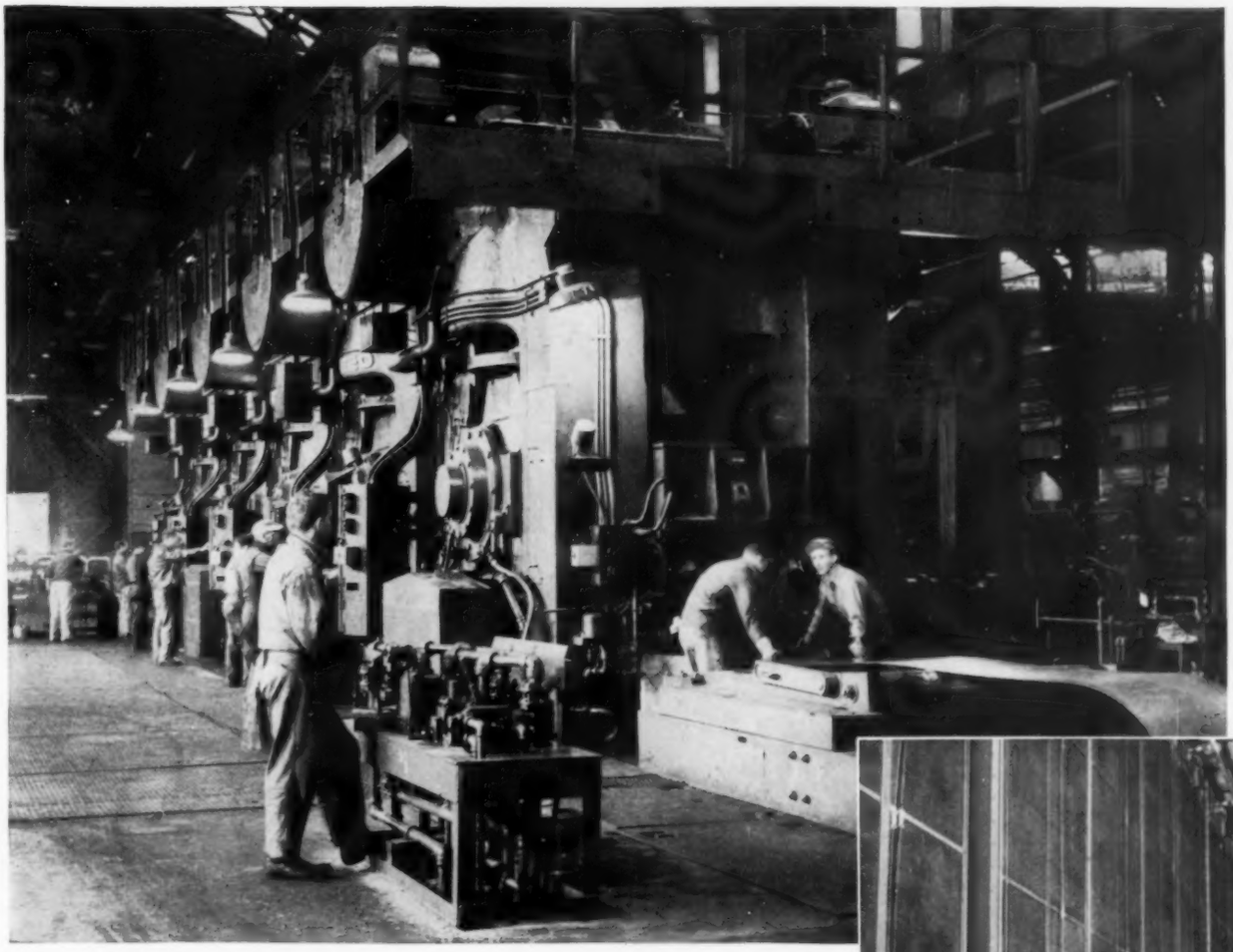
Twin finishing groups — double stranding—will have eight effective passes rather than the customary six, to further provide close tolerance control. The fast delivery speeds have necessitated the development by Lewis of special coiling features.

It is expected that the mill will be in operation early in 1953. It is reported that De Wendel will market much of its rod output to chain makers and other European manufacturers requiring very close tolerances.

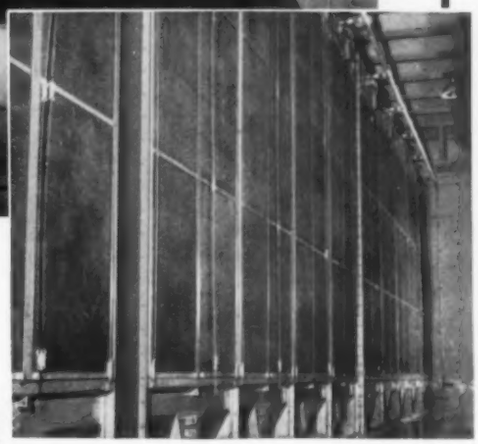
CRUCIBLE MOVES OFFICES TO PITTSBURGH, PA.

▲ The general offices of Crucible Steel Co. of America have been established in Pittsburgh, Pa. Crucible's quarters in the Oliver building have been enlarged several times since 1945 and, with this move, the number of people in the Pittsburgh offices will be more than 200, compared with about 30 seven years ago. W. H. Colvin, Jr., president, will establish an office in Pittsburgh.

today's best buy is better air!



▲ *Tandem cold strip mill at Weirton Steel Company.*



ELECTRO-MATIC ▶ *installation at Weirton.*

super-clean air and HIGH PRODUCTION SCHEDULES!

ELECTRO-MATIC Filters Protect Vital Mill Motors . . . reduce shut-downs and maintenance.

Today, *super-clean* air supplied by AAF Electro-Matic* precipitators protects thousands of mill motors against dust damage . . . and the resulting shut-downs that mean lost tonnage.

Here are the reasons why so many steel companies have installed Electro-Matics for mill motor ventilation. It is the *only* automatic, self-cleaning electronic precipitator and maintains highest cleaning efficiency over a wide range of particle sizes . . . from smoke to the largest air-borne material. Due to Electro-Matic's specially designed collector plates the filter curtain is non-clogging and insures uniform volumes of *super-clean* air. Also, exclusive self-cleaning feature reduces servicing to routine maintenance.

The Electro-Matic is made in standardized self-contained sections, which are easily installed in various arrangements to meet any air volume requirements. These may be equipped with oil clarifiers which continuously clean the Viscosine and simplify sludge removal.

For full story on *super-clean* air protection for mill motors call your nearby AAF representative or write to us for Engineering Bulletin No. 250 F.

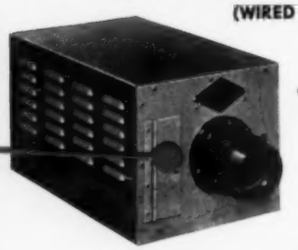
***ELECTRO-MATIC** *Automatic Electronic Precipitator.*

AAF **American Air Filter**
COMPANY, INC.

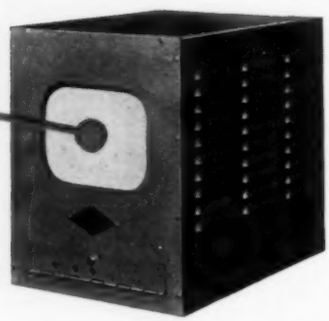
302 Central Avenue, Louisville 8, Kentucky • In Canada: Darling Bros., Ltd., Montreal, P. Q.

Quality Control Improved and DANGER ELIMINATED on tricky steel casting Job

with **DIAMOND "UTILISCOPE"** (WIRED TELEVISION)



"UTILISCOPE" CAMERA



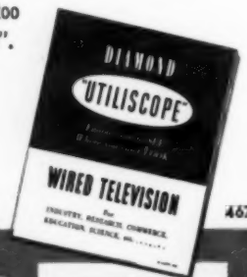
"UTILISCOPE" RECEIVER

On "Utiliscope" camera, operator safely watches molten metal rising in mold so he can accurately control rate of pouring.

To assure the superior quality required of large cast steel rolls for steel mill rolling equipment, it is necessary to control metal pouring speed very closely. The diameter changes abruptly between bottom, center and top of the mold; so the only way to regulate pouring effectively is to watch the hot metal coming up in the riser.

But that's too hot and dangerous for direct observation. The Ohio Steel Foundry Company tried to "do it with mirrors", but couldn't see enough. Now they do it with the Diamond "Utiliscope" (Wired Television). This gives them a clear view of what is going on inside the mold at all times . . . with no danger to the operator who watches on the "Utiliscope" receiver screen in safety and comfort.

Here is another instance where the Diamond "Utiliscope" solved a tough, tricky problem by enabling the operator to see what can't be looked at directly. If you have any process that is too hot, too cold, too dangerous, too remote, or too inaccessible to be watched directly, get information on the "Utiliscope". Write for Bulletin 1025E.



OTHER USES—Studying destructive testing of engines • Checking remote gauge readings • Observing conditions inside furnaces • Viewing nuclear research Coordinating materials flow on conveyors.

The "Utiliscope" (Registered U. S. Patent Office)

4670

DIAMOND POWER SPECIALTY CORP.
FIRST IN INDUSTRIAL TELEVISION
LANCASTER, OHIO • OFFICES IN 39 PRINCIPAL CITIES
Diamond Specialty Limited — Windsor, Ontario
Since 1903, Diamond has Manufactured Quality Equipment For Industry

WRITE FOR BULLETIN 1025E

The Crucible executive headquarters are being returned to Pittsburgh where they were located from the founding of the company in 1900 to 1921. For the past 31 years the general offices have been in New York's Chrysler building where a large office will remain.

The headquarters of W. P. Snyder, Jr., have always been in Pittsburgh where other companies he heads, including Shenango Furnace Co. and the Snyder Mining Co., have executive offices in the Oliver building. Mr. Snyder was elected chairman of Crucible in 1944, and has been a director of the company since 1930. He is a director of the Mellon National Bank and Trust Co.

Mr. Snyder's announcement stated: "The designation of Pittsburgh as the general offices' location follows a centralization of executive activities here that began in 1945. At that time Crucible was getting under way on a company-wide program of plant improvements, and was starting to realign and enlarge its organizations for operations, sales, technical services and administration. Except for certain specialized financial, sales and corporate activities which are best conducted in New York, the headquarters work of the company has gradually been centered in Pittsburgh.

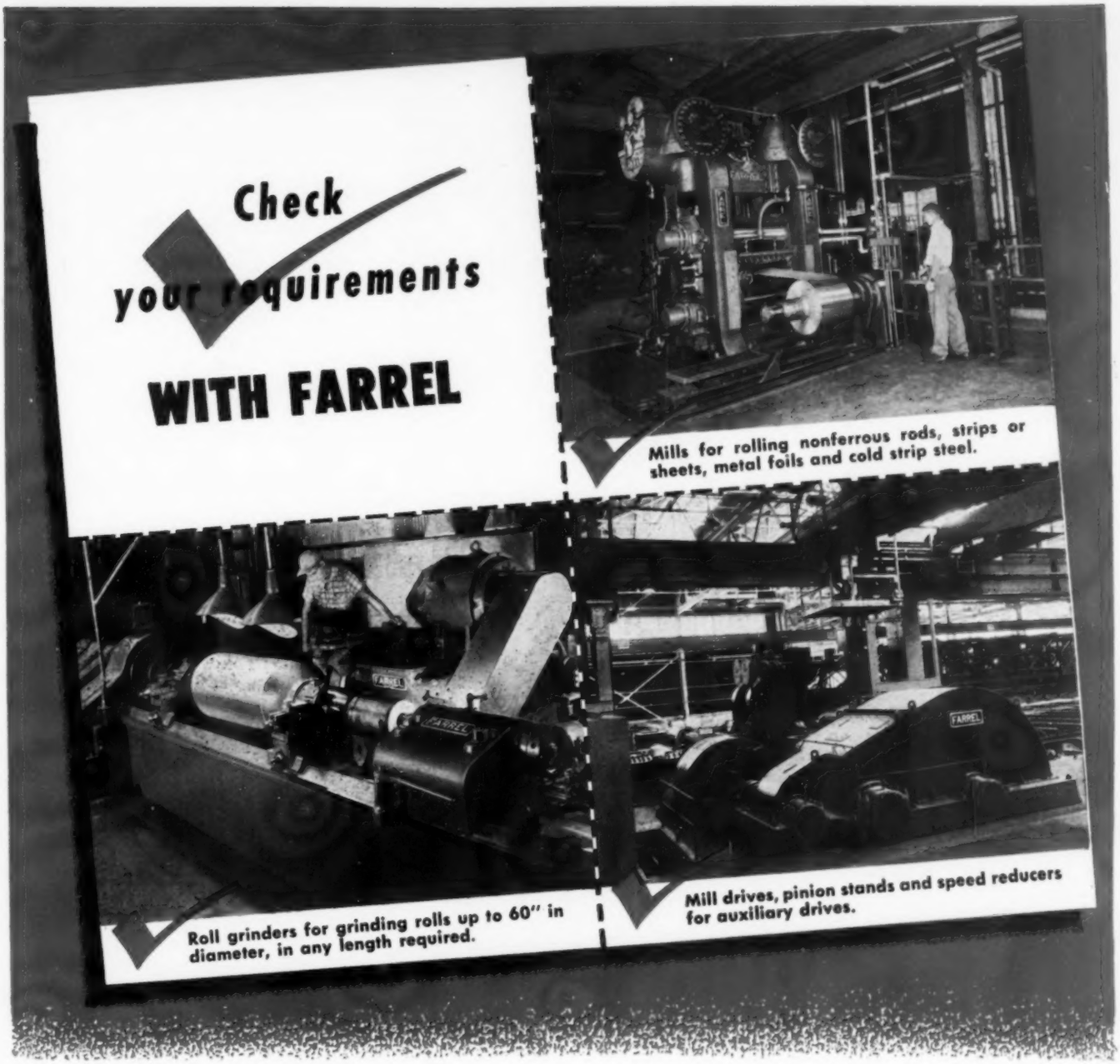
Since 1947, R. S. Poister, vice president in charge of operations, has made his headquarters in Pittsburgh. Sales headquarters were established here in 1949 when W. H. Wiewel became vice president in charge of sales. In line with the move, Joel Hunter, vice president in charge of finance, will establish a Pittsburgh office.

NEW PLANT TO RAISE SILICA BRICK OUTPUT

▲ An additional manufacturing unit is nearing completion at the Fairfield, Ala. plant of Harbison-Walker Refractories Co., according to the engineer-constructor, Rust Engineering Co.

The new unit will increase Fairfield production of silica brick by an estimated 50 per cent.

Existing raw materials handling facilities will service the added unit which is equipped to handle complete manufacture of the refractories used basically in building open-hearth steel furnaces, by-product coke ovens, and miscellaneous furnaces in the iron and steel industry and other industries.


Check your requirements
WITH FARREL
Mills for rolling nonferrous rods, strips or sheets, metal foils and cold strip steel.
Roll grinders for grinding rolls up to 60" in diameter, in any length required.
Mill drives, pinion stands and speed reducers for auxiliary drives.

For close to a century, Farrel has specialized in designing rolling mill equipment for the solution of specific production problems.

Mills are built in a wide range of types and sizes for rolling nonferrous rods, strips or sheets, metal foils and cold strip steel. The company also designs and manufactures the reduction gear drives and pinion stands, coilers and special handling equipment required to make each installation a complete production unit.

Speed reducers for auxiliary drives are available in a wide range of ratios and capacities. Designs include single, double and multiple reduction units; speed-change units; right-angle drives and drives to meet special requirements.

Another problem solver is the Farrel roll grinder. Available in two types and nine standard sizes, these machines enable you to fix and maintain definite standards of accuracy and finish. Rolls are produced with a perfect surface, free from marks of any kind, ground straight, or with concave or convex contours of exact symmetry and accuracy.

Information and engineering consultation regarding any of the products mentioned on this page are available, without obligation.

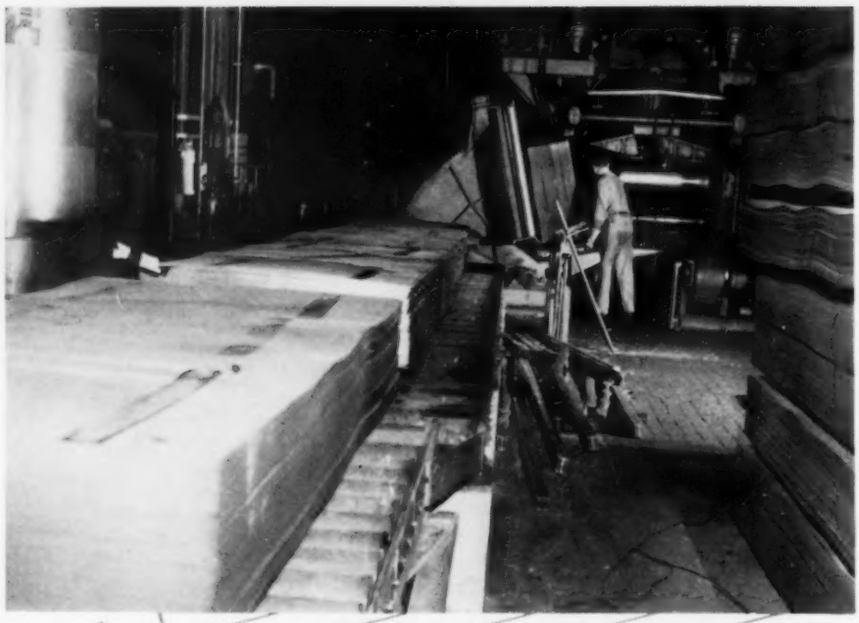
FARREL-BIRMINGHAM COMPANY, INC. • ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.

Sales Offices: Ansonia, Buffalo, New York, Akron, Pittsburgh, Chicago, Los Angeles, Houston

Farrel-Birmingham®

FB-700



for the best solution to that handling problem...

● When faced with material handling problems
—whether they involve conveying coils or sheet packs—keep in
mind the service of Mathews Engineers which is readily
available to you—Engineers who can help you
to get the right answers to these problems without confusion or delay.
You will find that it pays to depend on such
experienced sources of supply, for behind your Mathews repre-
sentative is a large engineering staff, a highly skilled
production force, modern plants and a back-
ground of nearly 50 years of service to the metal-working industries.
So, when handling problems turn up,
give them to Mathews Engineers. You'll be glad you did.

MATHEWS CONVEYERS

GENERAL OFFICES . . . . . *Mathews Conveyer Company*
ELLWOOD CITY, PENNSYLVANIA

PACIFIC COAST DIVISION . . *Mathews Conveyer Company West Coast*
SAN CARLOS, CALIFORNIA

CANADIAN DIVISION . . . . . *Mathews Conveyer Company, Ltd.*
PORT HOPE, ONTARIO

The Rust contract involved the production plant with the exception of kilns and driers. Field work on the new plant unit was begun in June of 1951.

RAILROADS CONSUME 8.6 PER CENT OF STEEL

▲ Railroads last year bought about 8.6 per cent of the total output of the nation's steel mills, according to preliminary estimates issued by the Eastern Railroad Presidents Conference.

The group noted that there are some 70,000,000 tons of steel rails in the nearly 400,000 miles of railroad track in the United States. In addition, a diesel locomotive takes some 117 tons of steel, a sleeping car about 70 tons and a box car nearly 40 tons, it added. All this puts railroads and railroad equipment makers among the best customers of the steel industry, it was pointed out.

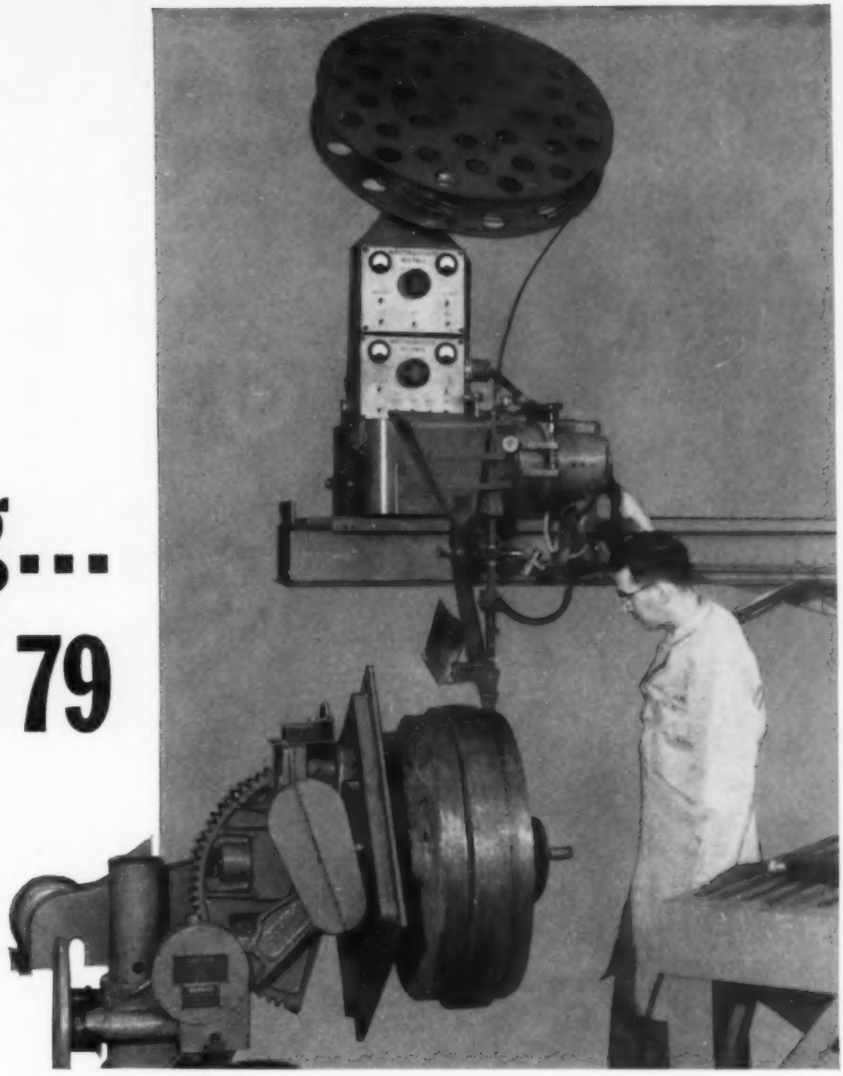
The conference also emphasized that the railroads are contributing to the steel industry's well-being by an accelerated scrap drive, which is expected to return almost 2,000,000 tons of scrap to the mills from the Eastern roads alone in 1952.

Average wholesale prices of steel products to the railroads have increased 110.9 per cent since 1940, while the cost of hauling these products by rail has been permitted to rise only 78 per cent, it was said. While the railroads realize that inflationary forces have dictated the steel industry's price increases, the conference declared, these figures strikingly illustrate the problem presented by increasing costs of operation. The failure of regulatory bodies to allow rail revenues to increase in proportion to higher costs is posing a serious threat to one of the steel industry's best customers, it added.

REYNOLDS PURCHASES ELECTRICAL EQUIPMENT

▲ An order for more than $5,000,000 worth of equipment has been received by Westinghouse Electric Corp. from Reynolds Metals Co., Richmond, Va.

The order is for 24 assemblies of "Ignitron" rectifier tubes, with 12 tubes in each assembly, and related electrical equipment to be installed in a new Reynolds aluminum reduction



Announcing... Amsco AW 79

for AUTOMATIC HARDFACING

AMSCO AW 79 will meet your every requirement for better control of wear where abrasion and high impact are important factors—plus giving you all the advantages of automatic welding. It can be used for reclaiming parts worn to uselessness or for increasing productivity of new parts.

The result of extensive research and field testing, AMSCO AW 79 is especially suitable for rebuilding and hardfacing tractor rollers and idlers. Back-up rolls, steel wheels, sheeting rolls, dredge pins, as well as dozens of other applications, can be successfully hardfaced with AW 79. It can be used on any conventional automatic submerged arc welding equipment now being used.

AW 79, the first in a series of rods by AMSCO for automatic hardfacing, is an alloy steel electrode fabricated by encasing particles of alloy metals in a continuous steel tube. Deposits are of martensitic alloy steel with chromium and molybdenum as the principal alloying agents. It is available in coils weighing approximately 100 lbs., each with an inside coil diameter of 22½", and is stocked in wire diameters of 5/32" and 3/16". Packed in cardboard containers with an anti-rust agent, other coil diameters and sizes are available on request. Write today for complete information.

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION
411 EAST 14th STREET · CHICAGO HEIGHTS, ILL.

Other Plants: New Castle, Del., Denver, Oakland, Cal., Los Angeles, St. Louis. In Canada: Joliette Steel Division, Joliette, Que.
Amsco Welding Products distributed in Canada by Canadian Liquid Air Co., Ltd.

plant near Arkadelphia, Ark. Ignitron rectifiers convert alternating current to direct current for the aluminum reduction process.

The new Reynolds plant will cost approximately $30,000,000 and will have a yearly capacity of 110,000,000 pounds of aluminum pig.

KAISER TO EXPAND PIG IRON OUTPUT

▲ A $65,000,000 expansion program that will increase Kaiser Steel Corp.'s pig iron output by 50 per cent and raise steel ingot production by more than 11 per cent was announced recently. Principal facilities in Kaiser Steel's latest move to boost production of metal at its Fontana, Calif., plant are: 1. A third blast furnace to smelt 438,000 tons of pig iron per year. 2. A ninth open hearth steel making furnace to add 156,000 tons of steel ingots annually to the Fontana production. 3. Ninety additional by-product coke ovens to turn out 408,000 tons of coke per year for use in the blast furnaces. 4. Two additional stands in the present hot strip mill, to enable it to roll and finish sheet of lighter gages and greater widths. 5. Major additions to equipment and housing at company-owned iron ore and coal mines.

The expansion will be carried out entirely with private financing, including $27,500,000 in loans from seven banks, a like amount of $27,500,000 from first mortgage bonds sold to seven insurance companies, and $10,000,000 of corporate funds. At the same time, the company is refunding a $25,000,000 bank loan obtained in November, 1950, making the total new bank loan in the amount of $52,500,000.

BRASSERT ANNOUNCES ORGANIZATION CHANGES

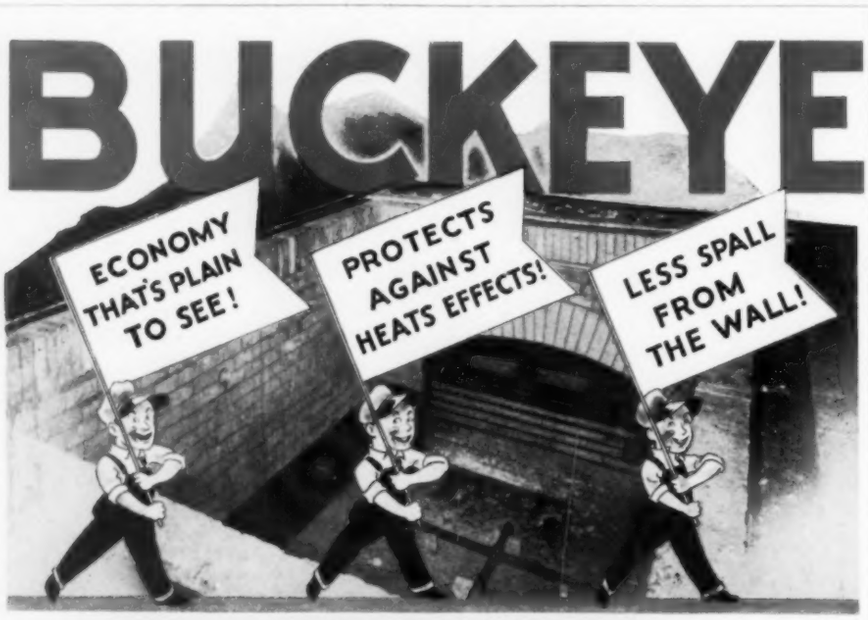
▲ The reorganization of H. A. Brassert & Co., Birmingham, Ala., and New York, N. Y., has been announced. H. A. Brassert will serve as chairman of the board and Franklin C. Senior as president. James E. Brassert and David R. Knall will be officers of the corporation. The company is continuing its activities as engineers to the iron and steel industry. The firm of Senior, Juengling and Knall is continuing its activities in the southeastern states, and the combined engineering and drafting operations will be handled in the Birmingham, Ala., office.

C. A. Brassert, president of the Standard Boiler and Plate Iron Co. of Pittsburgh announced the taking over of the activities of the H. A. Brassert Co. of Pittsburgh, Pa.

CHICAGO FIRM NAMES INDUSTRIAL DISTRIBUTORS

▲ The Rust-Oleum Corp., Evanston, Ill., leading manufacturers of rust-preventatives for over 25 years, has announced the addition of new industrial distributors to its distributor sales organization throughout the country.

The new distributor firms appointed are: Adkins Co., Baltimore Avenue, Berlin, Md.; Mill and Contractors Supply Co., 121-3 Water Street, Wilmington, N. C. Warren Hardware Co., 183 West Market Street, Warren, Ohio; American Radiator and Standard Supply Corp., 130 North 3rd Street, Zanesville, Ohio; Couch and Heyle, 1016 South Adams Street,



Want Longer Refractory Life ?
Specify BUCKEYE FIRESTONE!

More steel men select Buckeye Silica Firestone because it alone offers the valuable properties of natural stone. It lasts longer because it has greater resistance to temperature changes.

Buckeye doesn't warp because of drying or burning stresses. Its corrosive resistance, too, is an important factor in providing much better service. It has great strength to withstand shock of ingots striking against soaking pit walls . . . cuts spalling to a minimum !

It is best and Cleveland Quarries engineers will be glad to prove it with definite figures. Write us today !

THE CLEVELAND QUARRIES CO.
REFRACTORY DEPT.
1740 E. Twelfth St. CLEVELAND 14, OHIO

Ask For Bulletin 15—B

BUCKEYE
"FOR THAT EXTRA SERVICE"
SILICA FIRESTONE

"VERY MUCH IN FAVOR OF"

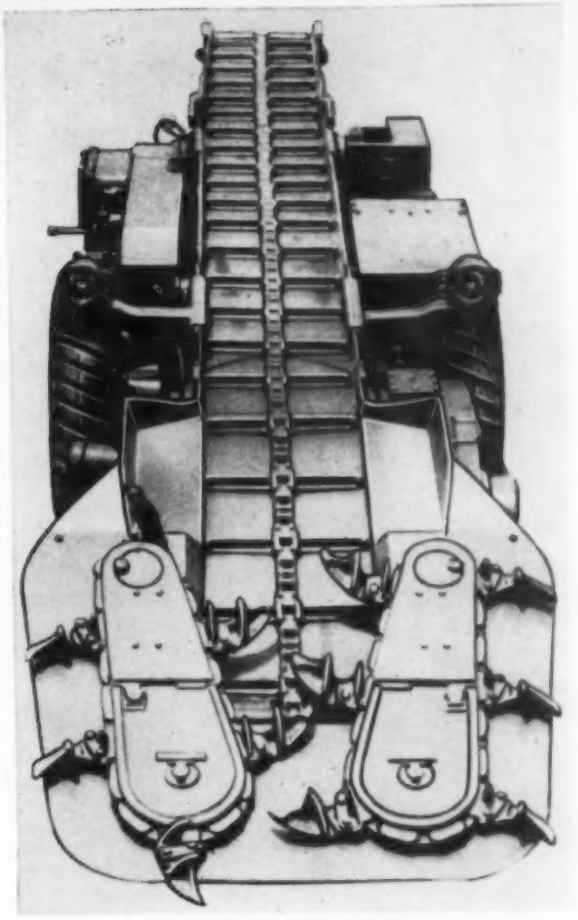
MARVEL SYNCLINAL FILTERS

Says: John L. Clarkson, President

The Clarkson Manufacturing Co., Nashville, Illinois

"In coal mining the coal dust settles on and around all parts, connections, and fill plugs. When the plugs for fill pipes are removed, invariably small particles of coal dust drop into the tank. When hose connections are connected in the mine, dust coal particles also get into the line. The filter catches this dust on its first trip around and prevents damage to the pump and cylinders. We are very much in favor of your filters."

John L. Clarkson



CLARKSON UNDERGROUND LOADING MACHINE
This machine, widely used in the coal mines, has its vital hydraulic power system protected by the Marvel Synclinal filter. Like over 250 other manufacturers. The Clarkson Manufacturing Company installs Marvel Synclinal filters as original equipment.

INCREASE PRODUCTION
REDUCE MAINTENANCE COST

Protect Hydraulic Equipment with Marvel Synclinal Filters

More and more manufacturers and users of hydraulic machines and other equipment with low pressure, non-corrosive liquid systems are depending on Marvel Synclinal Filters to protect their machines' efficiency. Marvel Synclinal Filters are speeding production in a wide range of industries. They offer longer periods of operation between cleanings plus simplicity which enables ordinary workmen to quickly disassemble, clean and reassemble the filter on the spot. Turning a single handnut releases line model for cleaning without disturbing pipe connections.

BOTH SUMP and LINE TYPES are available in individual capacities from 5 to 100 gallons per minute and in mesh sizes from 30 to 200.

SUMP TYPE (Cutaway) LINE TYPE (Cutaway)

WATER FILTERS In response to the great demand we have designed both our sump and line models for use in all water filtering applications.

Write for Complete Engineering Data • Specify Oil or Water

Meets J.I.C. Standards

MARVEL ENGINEERING COMPANY
625 W. Jackson Blvd. Chicago 6, Ill.

Peoria, Ill., Republic Supply Co. of Calif., 2600 South Eastland Avenue, Los Angeles, Calif.; and, Buhl Sons, foot of Adair Street, Detroit, Mich.

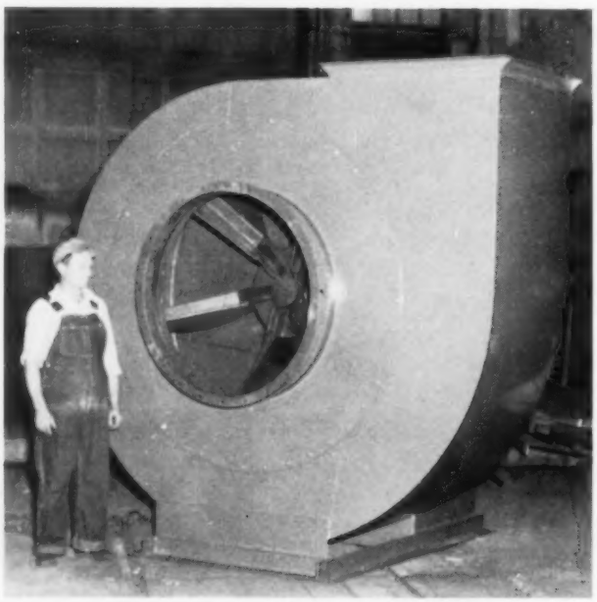
BORON STEEL SAVES NICKEL SUPPLIES

▲ The production of alloy steel ingots (other than stainless steel ingots), with the use of boron, was 70,077 net tons in January, nearly 2½ times as great as the average monthly production in 1951, American Iron and Steel Institute reported today. That total of boron steel, which conserves nickel, chromium and molybdenum, was 9 per cent of the total production of alloy steel excluding stainless in January. The monthly average last year was 4 per cent.

The recent rapid increase in the use of boron steels reflects intensive research and development work which started prior to the advent of war in Korea. Since aircraft and other defense work requires large tonnages of alloy steel, it became necessary to stretch the supply of scarce elements for civilian use. Boron, which is plentiful, is used in very small quantities to make substantial reductions in the use of various other alloying elements under certain circumstances.

The total production of alloy steel other than stainless in January was 778,495 tons, highest monthly output since World War II, compared with 705,364 tons in January 1951.

For Maximum Protection From Corrosive Fumes . . .



Giant Fume Remover lined with ⅛" thick Neoprene Rubber for Maximum Protection

Put Heil Lined Equipment To Work For You

A LONGER SERVICE LIFE assured in your lined equipment by our many years experience in applying with an unbiased selection of the best lining for your specific requirements.

• RUBBER • KOROSEAL • PLASTIC • LEAD
• LINED DUCTS • PICKLING TANKS • TANK COVERS
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Other Heil Products include: Steam Jet Agitators • Lined Pickling Tanks • Acid Proof Maintenance Materials • Lead Fabrication • Lined Steel pipe

SEAVER ENGINEERS REVAMP OHIO PLANT

▲ Jay J. Seaver Engineers have completed the engineering for a turbo-blower installation for Tennessee Products & Chemical Corp., Rockwood, Tenn.

The Seaver firm is now doing the engineering for the rehabilitation of the Jackson Iron and Steel Co. plant at Jackson, Ohio. This will include an iron ore unloading, storing, bedding and reclaiming system; turbo-blower, pumps, condensers, turbo-generators and double skip bridge with electric bell rigs and electric hoist; a coke screening, weighing and breeze disposal system; a primary and secondary gas cleaning system and fuel oil burners and water supply system.

KOPPERS TO BUILD J & L COKE OVENS

▲ Jones & Laughlin Steel Corp. has awarded Koppers Co., Inc., a contract to design and build a new battery of chemical-recovery coke ovens at its Hazelwood plant, Pittsburgh, Pa. The new ovens to be built as part of J & L's expansion and modernization program at Hazelwood, will be of the Koppers-Becker type.

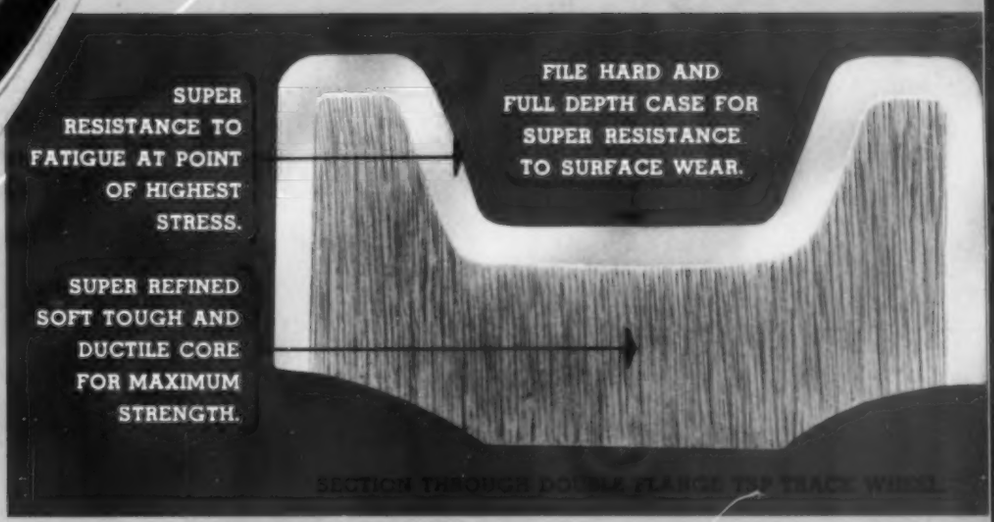
Work on the Hazelwood battery is to be pushed as rapidly as procurement of materials will allow. Koppers also will construct a new screening station, a new coal bin and a coal conveyor system.

BASIC ACQUIRES SIERRA MAGNESITE CO.

▲ Basic Refractories Inc. has acquired the physical assets of Sierra Magnesite Co. of Nevada. Basic also has obtained a lease to mining claims adjoining Basic's property at Gabbs, Nev., to be operated in conjunction with other properties of Basic.

TSP super resistance to wear and fatigue

guaranteed longer track wheel life!


SUPER RESISTANCE TO FATIGUE AT POINT OF HIGHEST STRESS.
SUPER REFINED SOFT TOUGH AND DUCTILE CORE FOR MAXIMUM STRENGTH.
FILE HARD AND FULL DEPTH CASE FOR SUPER RESISTANCE TO SURFACE WEAR.

TOOL STEEL PROCESS PRODUCTS

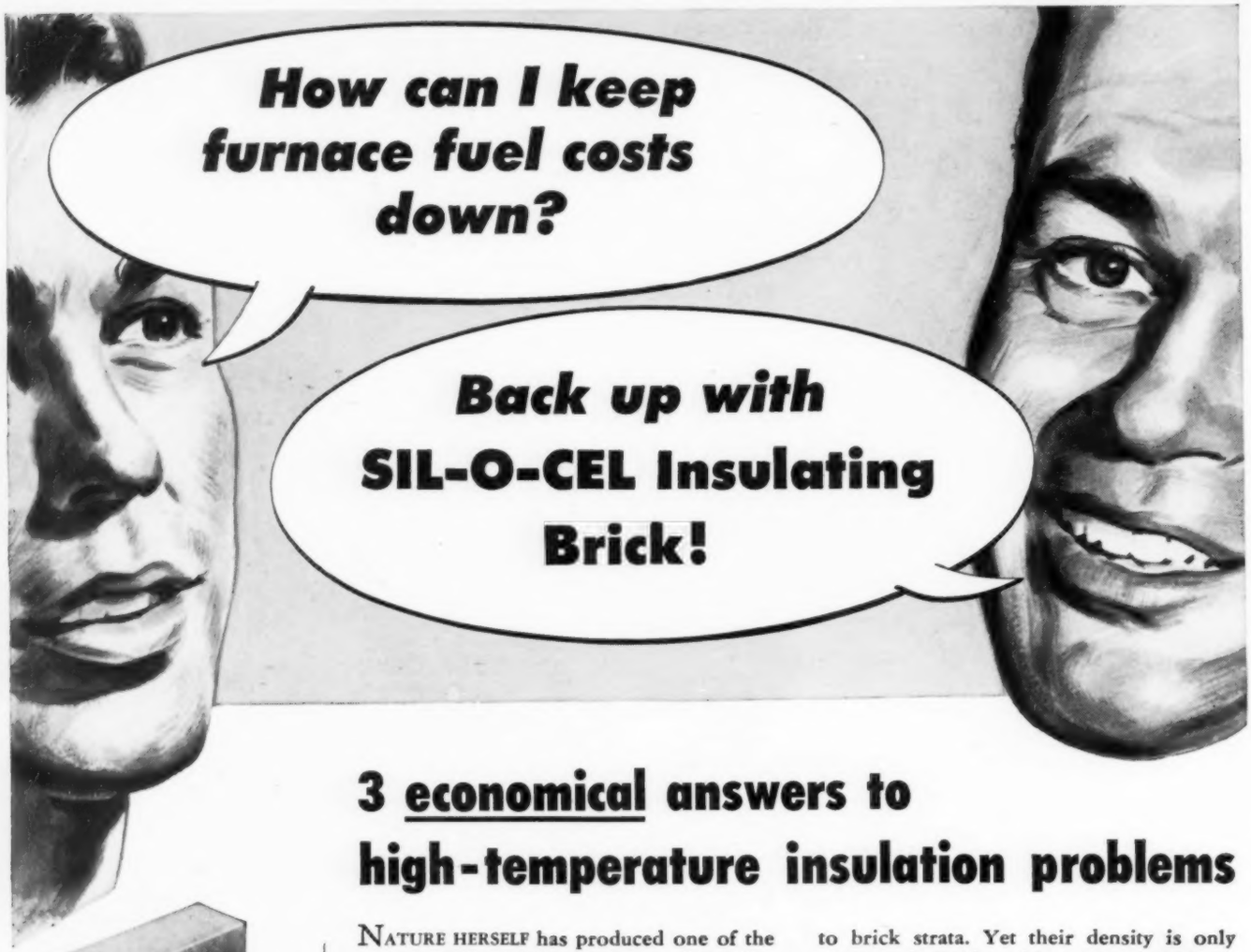
. . . the products that carry an absolutely positive GUARANTEE to give a longer life in the same service than any other product.

By actual tests "Tool Steel Process" track wheels are outlasting ordinary wheels by as much as 15 and even 20 to 1. This is due to the fact that the file hard case or wearing surface penetrates to the depth or limit of permissible wear, resulting in the phenomenal long life that only "Tool Steel Process" wheels can give you. If you're planning a replacement, the tremendous advantages in operating and maintenance costs you receive from guaranteed "Tool Steel Process" products, will pay you big dividends.

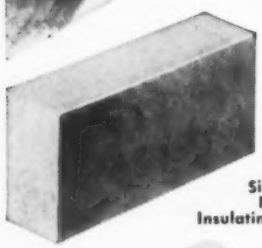
Write for Bulletin 1250 describing other "Tool Steel Process" wheels for all services.

THE TOOL STEEL GEAR AND PINION COMPANY

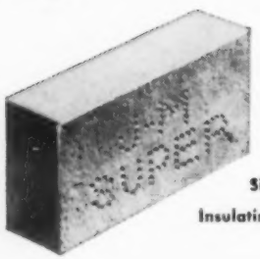
CINCINNATI 16, OHIO • U.S.A.



3 economical answers to high-temperature insulation problems


Sil-O-Cel Natural Insulating Brick

Sil-O-Cel C-22 Insulating Brick


Sil-O-Cel Super Insulating Brick

NATURE HERSELF has produced one of the most effective high-temperature insulating materials ever discovered—diatomaceous silica, from which Sil-O-Cel® Insulating Brick are made.

These insulating brick are used for back-up insulation behind fire brick or insulating fire brick linings in boilers, stills, stacks, heat-treating furnaces, kilns, lehrs, flues, retorts, and other types of high-temperature equipment.

Sil-O-Cel Insulating Brick have excellent insulating qualities combined with high load-bearing characteristics and light weight.

Made in all standard shapes of the 2½ in. and 3 in. series, Sil-O-Cel Insulating Brick are produced in three basic types:

SIL-O-CEL NATURAL INSULATING BRICK
for temperatures to 1600F

Quarried directly from one of the world's purest deposits of diatomaceous silica, these insulating brick have a conductivity of only 0.79 Btu in./sq ft/F/hr at 1000F mean temperature, with heat flow perpendicular to brick strata. Yet their density is only 30 lb/cu ft. Cold crushing strength, 400 psi.

SIL-O-CEL C-22 INSULATING BRICK
for temperatures to 2000F

Ideal where high load-bearing properties are needed, this type of Sil-O-Cel is calcined, and has a cold crushing strength of 700 psi. Conductivity is 1.88 Btu in./sq ft/F/hr at 1000F mean temperature. Density, 38 lb/cu ft.

SIL-O-CEL SUPER INSULATING BRICK
for temperatures to 2500F

A calcined insulating brick for unusually high temperatures. In many cases, it is also possible to save on construction costs by reducing the thickness of fire brick or insulating fire brick when backed with Sil-O-Cel Super Insulating Brick. Conductivity is 1.95 Btu in./sq ft/F/hr at 1000F mean temperature. Density, 40 lb./cu. ft. Cold crushing strength, 300 psi.

For further information, write to Johns-Manville, Box 290, New York, N. Y. In Canada, write 199 Bay St., Toronto 1, Ont.

JOHNS-MANVILLE JM PRODUCTS **Johns-Manville** *first in* **INSULATIONS**

30% GREATER CONTACT TRAVEL

With NEW KEYSTONE LMI PONY SIZE COLLECTORS

New advantages . . . new economies . . . are now offered with the Keystone LMI Pony Size Collectors! These new collectors are designed for continuous, efficient performance despite severe operating conditions. Outstanding advantages include: improved contact shoe, readily reversible, provides 30% greater contact travel, adds 300% more wearing thickness on each side, lower in overall height.

Solderless throughout, shunt connectors have non-loosening electrical connections. Copper plating on machined surface insures better electrical contact where shunt is connected and prevents corrosion. Maintenance simplified. Only one tool required.

The new Keystone LMI Pony Size Collectors last longer . . . help you reduce inventories and give improved service. For complete information ask for Bulletin 681B. Write today.

OUTSTANDING FEATURES

- 30% greater contact travel
- Improved contact shoe
- Efficient current transfer
- Solderless shunt connectors
- Rapid contact reversal
- Compensating terminal
- Lower overall height
- Collector reversible
- Easy to maintain

ELECTRIC SERVICE MANUFACTURING CO.

PHILADELPHIA 32, PENNA.

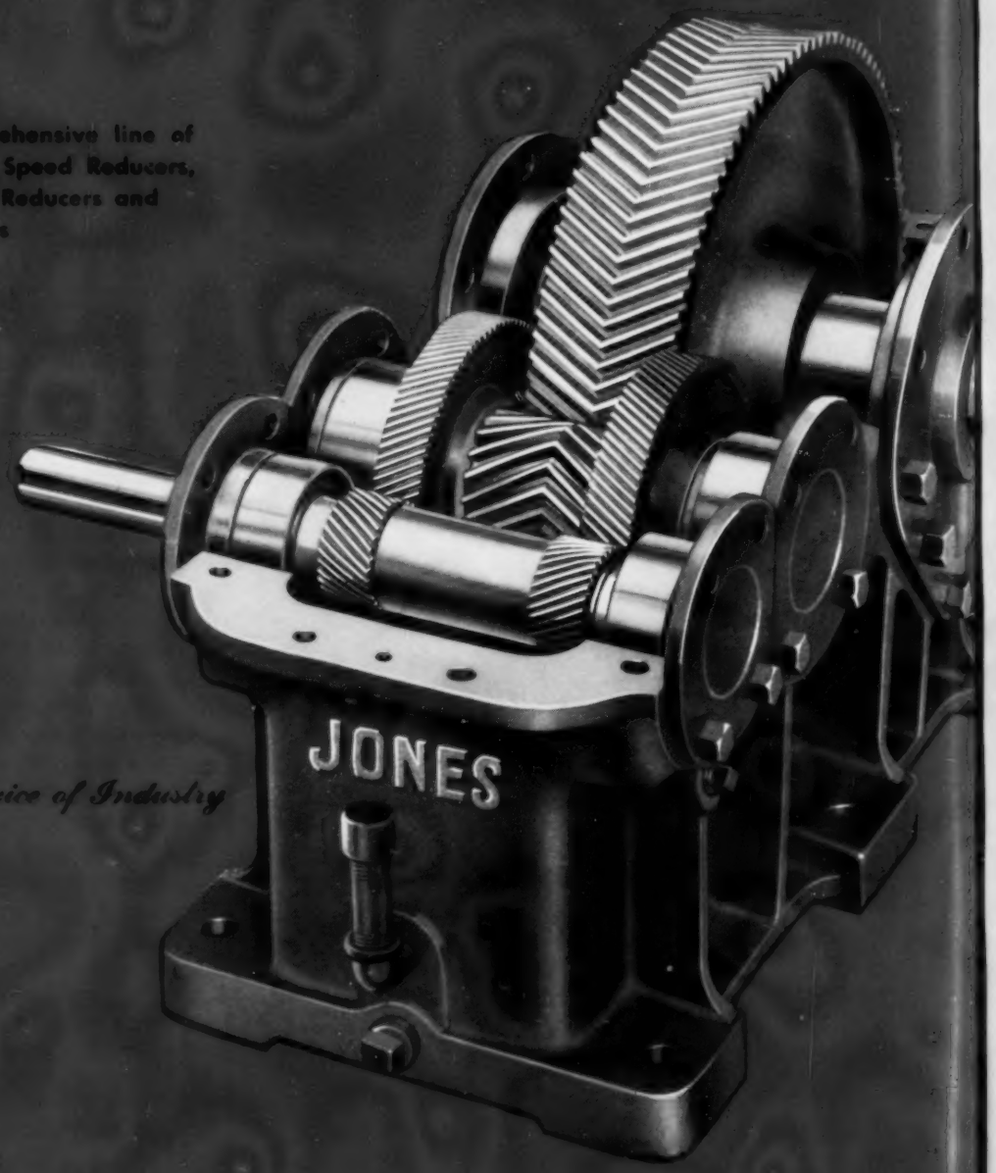
MANUFACTURERS OF COMPLETE LINE OF INSULATOR SUPPORTS FOR RAIL AND WIRE CONDUCTORS AND CURRENT COLLECTION DEVICES.

MORE STANDARD SIZES TO CHOOSE FROM

In the range from 1 to 400 horsepower JONES offers the most complete line of Herringbone Gear Speed Reducers available *ANYWHERE*.

Jones

Manufacturers of a comprehensive line of quality Herringbone Gear Speed Reducers, Worm Helical Gear Speed Reducers and Worm Gear Speed Reducers



Since 1890... In the Service of Industry

W. A. JONES FOUNDRY & MACHINE COMPANY, 4401 Roosevelt Road, Chicago 24, Illinois

VARIETY OF BODY TYPES
SIMPLE, POSITIVE DESIGN
ON CONDUIT
With conduit lock nut in sheet metal cabinet.
With hexagon nipple in power distribution duct.
PYLET
In taper-threaded Pylet hub.

Protect

electrical equipment and keep maintenance costs down with

PYLE-NATIONAL

SEALING GRIPS for flexible cords & cables

Pyle accurately-cut tapered threads and tapered rubber bushings assure a positive grip with a water-tight and dirt-tight seal preventing strain on terminal connections and deterioration of electrical parts or intricate mechanisms.

With Pyle sealing grips installed, tension or strain on the portable cord or cable is taken up by the gripping action instead of the wire terminal connections. At the same time this sealing action prevents moisture or dirt from entering the wiring compartment or mechanism enclosure.

Aluminum bodies are available in a variety of styles and sizes including types with hexagon nipple for anchoring in sheet metal panels, cabinets or overhead power distribution ducts.

Compression nuts can also be furnished with a split mechanical clamp, a cord protecting spring, or with an attachment for rubber hose or flexible conduit. Two and three hole rubber bushings are also available.

Write today for Pyle-National Bulletin No. 1145 for complete listings.

SINCE 1897

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1383 NORTH KOSTNER AVENUE, CHICAGO 51, ILLINOIS
Branch Offices and Agents in Principal Cities of the United States
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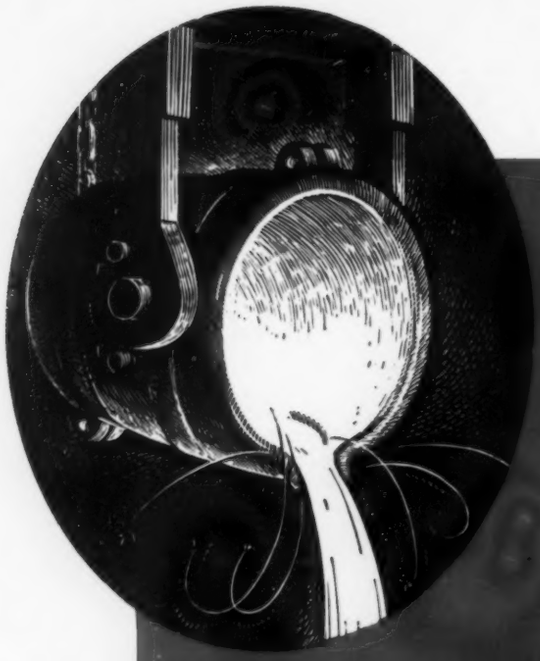
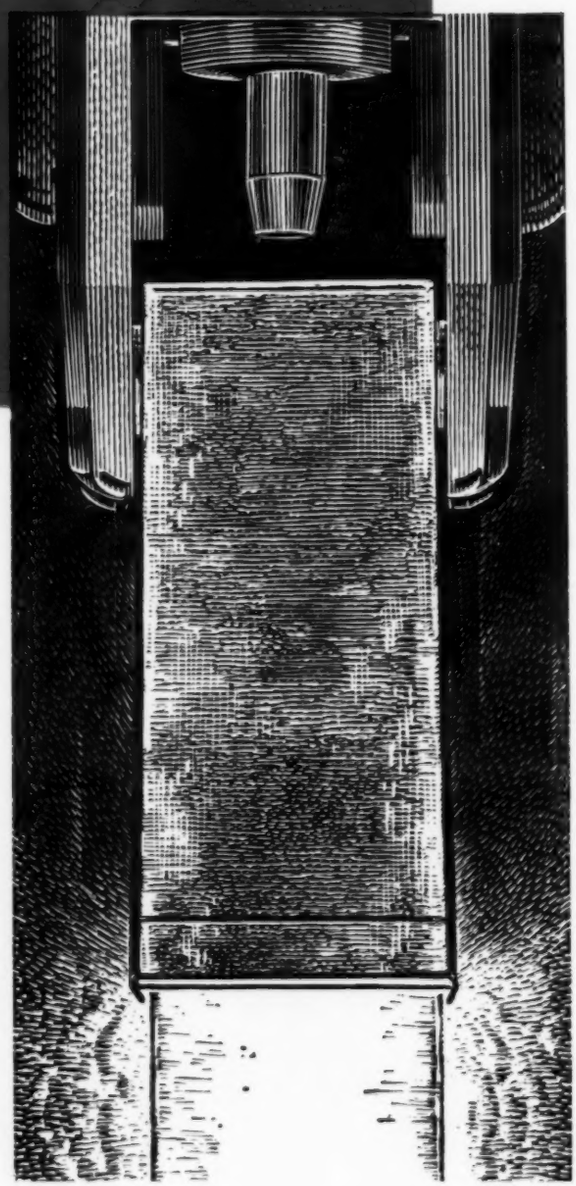
CONDUIT FITTINGS • GYRALITES • TURBO-GENERATORS • FLOODLIGHTS • PLUGS & RECEPTACLES • MULTI-VENT AIR-DISTRIBUTION



POUR FASTER...

STRIP FASTER.



AND ADD LIFE TO CRITICAL MATERIALS with NATIONAL TRADE-MARK Graphite Stool Inserts!

Mold stools with graphite inserts stand up to the hot-metal impact of fast, uniform pouring... absolutely *eliminate* the bottleneck of stool-sticker slow-ups. Ingot cars move evenly... you get greater man-hour productivity and, incidentally, much longer life from essential materials and equipment.

Write to National Carbon Company for information.

The term "National" is a registered trade-mark of Union Carbide and Carbon Corporation

NATIONAL CARBON COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.
District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco
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Personnel News...

Nelson W. Dempsey has been appointed manager of operations of the Chicago district of American Steel & Wire, division of U. S. Steel. Mr. Dempsey succeeds to the position formerly held by **John R. Gaut,** deceased. Mr. Dempsey's first association with American Steel & Wire was in May, 1917 when he started work as a laboratorian in the physical laboratory at South works in Worcester, Mass. He was transferred to Cleveland in October, 1920 as an instructor in the education bureau and subsequently served in the same capacity at Pittsburgh. He continued to progress through the ranks until in February, 1943 he was named assistant to the superintendent at North works in Worcester. In February, 1944 he was transferred to Waukegan, Ill. as superintendent at that plant's wire division and in January, 1948 he was promoted to the post of general superintendent of that plant. In September, 1950 he was transferred to Cleveland as general superintendent of Cuyahoga works, a post which he held until December, 1951, when he was appointed assistant manager of operations in the Chicago district, which duties he now relinquishes to assume his new position.

George H. Greene, chief engineer of Bethlehem Steel Co.'s plant at Johnstown, Pa., has been promoted to the post of assistant general manager. Mr. Greene has been chief engineer since 1949, having been assigned to the Johnstown plant after holding the same post at the company's Steelton, Pa. plant from 1946. Succeeding Mr. Greene as chief engineer is **Allen N. Reynolds, Jr.,** engineer of construction at Johnstown since 1950. Mr. Greene's appointment will give **A. J. Fisher,** general manager, two assistant general managers, **W. D. MacDonnell** having served in that capacity since September 1, 1949.

Arthur A. Levison was named vice president and general sales manager of the Blaw-Knox Division of Blaw-Knox Co. In this position, Mr. Levison will administer the sales and engineering functions for all departments of this division. Mr. Levison has been a division vice president in charge of the construction equipment department. It was also announced that **H. Russell Loxterman** has been appointed assistant general sales manager of the Blaw-Knox division. In addition to his new duties, Mr. Loxterman will continue as manager of the steel plant equipment department.

H. M. Reeser, vice president and secretary, and **D. M. Horner,** vice president, have been elected to the board of directors of the Harrisburg Steel Corp., Harrisburg, Pa.

Clarence J. Klein has been appointed vice president of the Weirton Steel Co., Weirton, W. Va. in charge of all engineering. Mr. Klein succeeds vice president **E. W. Rieger** who recently resigned due to ill health. Mr. Klein has been chief engineer for the company for more than 23 years. Mr. Rieger has been connected with Weirton Steel for the past 36 years. In early life he was a draftsman with the engineering department. Later he rose to general manager of the tin mill in 1927. He was next general superintendent of both the tin mill and sheet mill, and was appointed vice president in September 1, 1936. **W. Harry Wright** has been appointed chief engineer for Weirton Steel succeeding Clarence J. Klein. **L. A. Fugassi,** former development engineer, was appointed chief draftsman. **L. J. Baird,** an employee of Weirton Steel since 1938, was appointed assistant chief draftsman, and **E. D. Gossett** was appointed engineer in charge of buildings and structures.

Emmett A. Brady has been named works superintendent of the coke works of American Steel & Wire division of United States Steel, Cleveland, Ohio. Mr. Brady came to the Cleveland coke works of the wire division in 1918 from the Illinois Steel Co. Assuming new duties as a result of Mr. Brady's promotion are **George A. Curran,** who was appointed department superintendent of batteries and coal handling, and **John W. Harter,** who was appointed department superintendent of benzol and coal chemicals.

Charles C. Womack was appointed assistant to general superintendent and **David H. Everest** was appointed plant industrial engineer of U. S. Steel's Youngstown, Ohio, district works. Mr. Womack had been plant industrial engineer and Mr. Everest had been acting as his assistant.

NELSON W. DEMPSEY

GEORGE H. GREENE

ARTHUR A. LEVISON

H. RUSSELL LOXTERMAN

CLEAN WATER IN YOUR PLANT

Prolongs the working life span of all equipment that is cooled, heated or actuated by water.

Adams Poro-Stone filters convert your turbid supply to water of any degree of clarity you require. Used with or without filter aid, operated manually or automatically, Poro-Stone filters may be spotted throughout the plant at points of need or centrally installed for plantwide distribution.

Complete, packaged Adams filtration plants include filter aid precoat tank, continuous filter aid feeder, pressure backwash system, pump, valves and piping.

WRITE FOR BULLETIN 691

R. P. ADAMS CO., INC.

223 E. PARK DRIVE, BUFFALO 17, N. Y.

Satisfying A.I.S.E. specifications, Browning Mill Type Cranes incorporate types of motors and controls on which you have standardized. This flexibility suits your VRB crane *perfectly* to your needs. Our design, springing from 50 years' experience, places plenty of strength where it is required.

"Built as you yourself would build them"

Ask for our Bulletin "E"

VICTOR R. BROWNING & COMPANY, Inc.
BOX 309, WILLOUGHBY (CLEVELAND), OHIO
Designers and Builders of Electric Overhead Traveling Cranes and Hoists and Electric Revolving Cranes

Robert C. Becherer has been elected president of Link-Belt Co., Chicago, Ill., succeeding **George P. Torrence,** who is retiring from active service in accordance with the company's retirement plan. Mr. Becherer had been serving as executive vice president.

George J. Chandler has been named as sales engineer for Sauereisen Cements Co., Pittsburgh, Pa.

J. L. Whitten, vice president and sales manager of Lee Wilson Engineering Co., Inc., is now general manager of the company in addition to his previous duties.

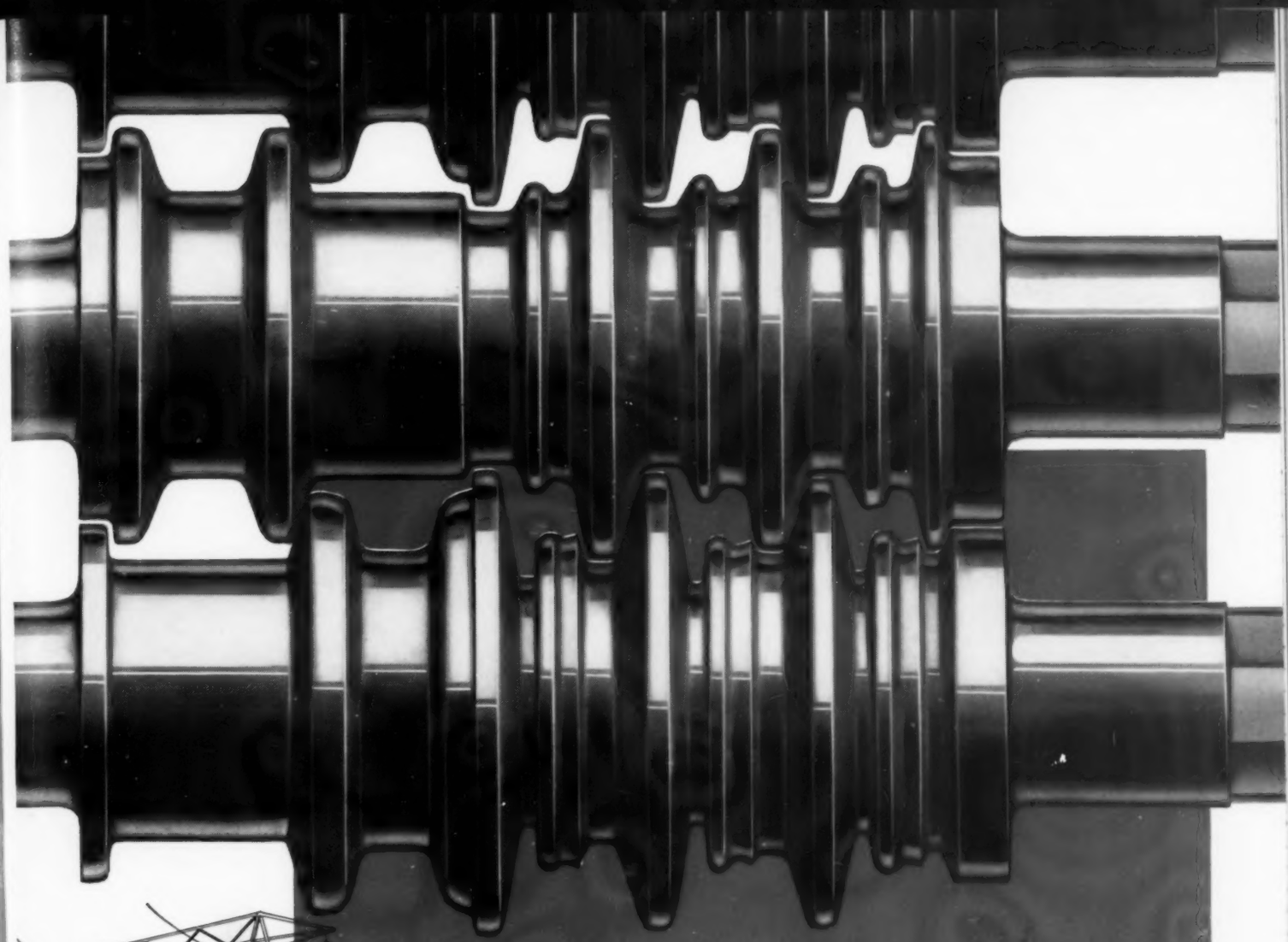
J. L. WHITTEN

V. L. Miller, was appointed chief engineer of the company succeeding **H. H. Armstrong** who resigned. **W. R. Watt,** who recently joined the company as assistant to the president in charge of priorities has now also been made production manager.

V. L. MILLER

Everett H. Gilmartin was appointed superintendent of industrial relations for Brainard Steel division of Sharon Steel Corp. Mr. Gilmartin will be located at the Griswold Avenue plant in Warren, Ohio. Mr. Gilmartin comes to Brainard from the United States Rubber Co., Passaic, N. J., where he was assistant to the industrial relations manager.

J. H. Stockfisch was appointed maintenance engineer of Sharon Steel Corp., Sharon, Pa. Mr. Stockfisch, a registered professional engineer, has been field engineer for the company since August 1, 1935.



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SHAPING METAL FOR ALL INDUSTRY

STEPPED-UP PRODUCTION

Greatly-enlarged plant facilities at Lima mean more Ohio Rolls to enhance your production. Choose from 11 types of Ohio Iron and Steel Rolls:

- Carbon Steel Rolls
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- Chilled Iron Rolls
- Denso Iron Rolls
- Nickel Grain Rolls
- Special Iron Rolls
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- Flintuff Rolls
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THE OHIO STEEL FOUNDRY CO.

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MARK FLATS AND ROUNDS

THE SAFE EASY WAY

Designed for marking hot or cold products, this unit features a reinforced outer box which levels the type holder on the piece being marked. The type holder is made of Mecco Safety Steel to give maximum resistance to spalling and mushrooming—thereby assuring greatly increased service life. Made for any size type.

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Mecco SAFETY BOX TYPE HOLDER

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SAFETY STEEL STAMPS

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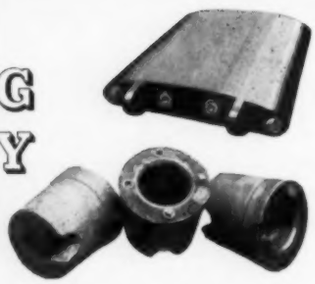
TO OPERATING EFFICIENCY



If air could conduct heat better than water, you would circulate air through your copper cooling plates. But you are aware of what trapped air does to a tuyere or to a bosh plate. It has been a major threat to operating efficiency . . . and Falcon non-ferrous casting specialists have come up with the answer. Falcon has created an AIR-FREE COOLING PLATE and an AIR-FREE TUYERE.

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YOUNGSTOWN 3, OHIO

Established 1890 - Incorporated 1895

Dr. Harry G. Mitchell of the Speer Carbon Co., St. Marys, Pa., has received an award for outstanding accomplishment in the advancement of powder metallurgy and its greater application in industry which was presented by the Metals Disintegrating Co., Union, N. J. Dr. Mitchell has pioneered in powdered metallurgy research since 1926 and has made several notable contributions to the industry including metal-graphite brushes. Aside from his work in the field of powder metallurgy, he developed a therapeutic carbon and conducted extensive research on electrolytic anodes.

F. R. Owens has been elected president of Cyrus Wm. Rice and Co., Inc., succeeding **Harry E. Einert,** deceased.

John G. Greenwood has joined the Continuous Metalcast Co., Inc., New York, N. Y., where he is in charge of sales. Mr. Greenwood was formerly special representative to the steel industry for Ingersoll-Rand Co.

Peter V. Martin has been appointed a vice president in Koppers Co.'s Engineering and Construction Division. On March 15 Mr. Martin will leave for Santiago,

PETER V. MARTIN

Chile, where he will become Koppers representative on the board of directors of the Pacific Steel Co. of Chile. Koppers supervised the construction of a new integrated steel mill in Chile and is continuing to give supervisory assistance in its operation.

C. K. Hood, formerly manager of the Worthington Corp.'s New York district sales office was elected to a vice presidency. Mr. Hood will be responsible for the direction of the activities of the public works, steam power, deaerating, water treating, and steam turbine divisions.

Dale D. Spoor, former chief of the Industries Branch of the Metalworking Equipment Division of NPA has been appointed manager of equipment and process sales department of Air Reduction Sales Co. In March, 1951, Mr. Spoor was granted a leave of absence from Airco to organize the Welding Equipment Section of the Machinery Division of the NPA.

C. E. Walker has been elected vice president in charge of operations of Vulcan Mold & Iron Co., Latrobe, Pa.

(*Please turn to page 164*)

Which Square D Control Center will do *Your* job best?

1. STANDARD
2. BACK-TO-BACK
3. DUST-TIGHT
4. WEATHER-PROOF
5. FILTERED AIR

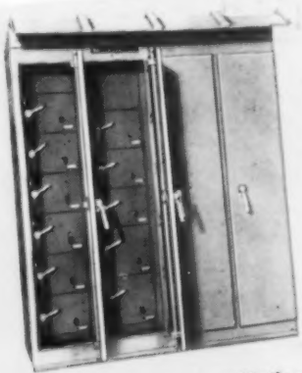
1 Standard Square D Plug-in Control Centers in Nema I enclosures are designed for the majority of installations.

SQUARE D FOR FLEXIBILITY! Square D's plug-in units can be removed, added, or exchanged at will. Both fusible switch and circuit breaker types available. Standardized sections and units are 100% re-usable after plant conversions or rearrangements.

Write for Bulletin 8938. Address Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin.

2 Space an Important Factor? Back-to-back Nema I enclosures provide maximum concentration of control in limited space.

3 for Excessively Dusty Locations—felt-gasketed, dust-tight, Nema V enclosure. A "natural" for foundries, smelting and refining plants.



4 for Outdoor Installations—rubber-gasketed, Nema III enclosure protects equipment from weather. Special rust-proof, vinyl-clad finish.

5 Need Filtered Air Protection? Built-in fan and filter combination pressurizes enclosure for moderately dusty or certain types of corrosive atmospheres.

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personal contact . . .

a sure way to see and sell Important Buyers in the Steel Industry

There is no better way of selling the important buyers of the giant steel mill market than through *Personal Contact.* The big 1952 Iron and Steel Exposition provides the opportunity this year to see and sell—in person—the men of this fast moving industry—at a time when they are eager to learn of new and improved ideas, products, supplies or services.

For booth space . . . get in touch with us at once as there are a few good locations still remaining. They are going fast, so write, 'phone or wire today.

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CLEVELAND
Public Auditorium

Sept. 30, Oct. 1, 2 and 3

YOUR GEARS LAST MUCH LONGER

. . . when protected with TEXACO MEROPA LUBRICANT

Here's the big reason why your enclosed reduction gears run better and last longer with *Texaco Meropa Lubricant*: its "extreme pressure" characteristics stand up through month after month of the severest service.

Along with this EP stability, *Texaco Meropa Lubricant* has extra-high resistance to oxidation and thickening. It does not foam; will not separate in service, storage or centrifuging. Bearings as well as gears get extra protection. Your maintenance costs come down.

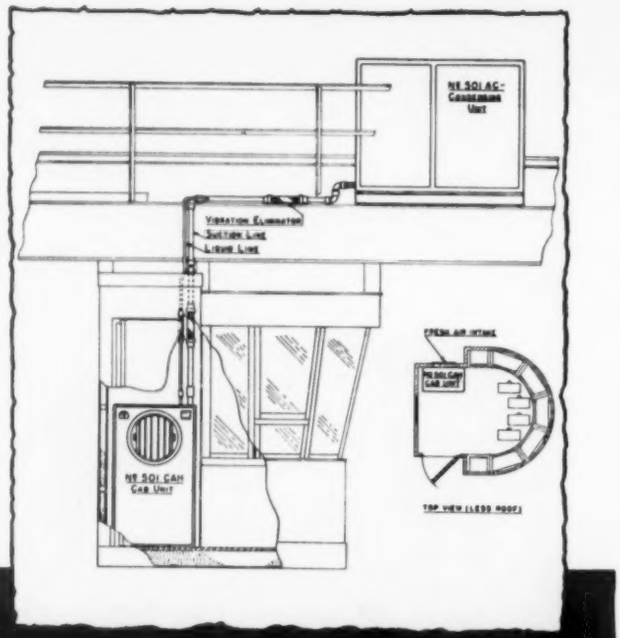
FOR OIL FILM ROLL NECKS, use *Texaco Regal Oil*. This turbine-quality oil for heavy-duty service has superior resistance to oxidation, emulsification and sludging. You'll get smoother operation, reduce your maintenance costs.

Let a Texaco Lubrication Engineer show you how effective lubrication — *Texaco* — can step up efficiency and step down costs throughout your mill. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, New York.

TEXACO Meropa Lubricants
FOR STEEL MILL GEAR DRIVES

Faithfully yours 50 *for Fifty Years*

TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE on television every Tuesday night. See newspaper for time and station.



The Original Split System Cab Conditioner

This is the original split system now in use for over four years. Its operating efficiency has been unequalled. Throughout this period the Lintern split system has demonstrated its greater cooling efficiency, lower maintenance, and trouble-free operation. All of the many installations throughout the country have given universal satisfaction:

In the Lintern split system Aire-Rectifier the condenser is located at any convenient place on crane, and evaporator (cooling coil) is placed in cab. The two units are connected with refrigerant lines properly secured and protected against breakage. Condensers are air-cooled, assuring trouble-free service with but little maintenance.

Requiring but little space, the condenser and cab units are easy to locate, respectively on crane and in cab so that they do not interfere with operations in any way.

These Aire-Rectifiers hold properly insulated cabs at a cool 85° F. and relative humidity of 30% to 50% at ambient temperatures of 170° without excessive head pressures or wear on the machine.

May we send you complete information on the Lintern split system Aire-Rectifier (patents pending) and its application to your particular needs?

THE LINTERN CORPORATION

29-2 RIVERSIDE DRIVE • BEREA, OHIO

(*Continued from page 160*)

Norman A. Matthews has been appointed assistant chief metallurgist of American Brake Shoe Co.'s metallurgical research department at Mahwah, N. J. He was formerly division metallurgist for the Electro-Alloys division at Elyria, Ohio.

Lloyd R. Cooper, director of research of Heppenstall Co., Pittsburgh, Pa., has been appointed chief metallurgist of Heppenstall's plant at Eddystone, Pa. **Dr. Robert B. Corbett** was named acting director of research at the Pittsburgh plant.

Joe E. Kiefer has been named vice president in charge of sales and engineering of the Arms-Franklin

JOE. E. KIEFER

Corp., Youngstown, Ohio. Mr. Kiefer before assuming his new position was chief engineer of Stamco Inc., New Bremen, Ohio, for the past fifteen years. **John P. Walsh** was placed in charge of sales promotion. Mr. Walsh was associated with Lombard Corp. and Wean Engineering Co., Inc. prior to assuming his present position. **L. L. Freret** was appointed chief engineer. Mr. Freret was formerly with Arthur G. McKee & Co., Cleveland, Ohio, and prior to that he was with National Tube Co. at Lorain, Ohio.

L. L. FRERET

John F. Toppi has been named special representative to the iron and steel industry for Ingersoll-Rand Co. Mr. Toppi will be located at 932 Penn Avenue, Pittsburgh, Pa.

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You need this up-to-the-minute 56-page edition of Bristol's famous book if you're involved with thermocouples and pyrometers of any kind. It's free for the asking. Here's what you get in its three, fact-packed sections . . .

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3. You get Thermocouple Calibration Data ...complete, easy-to-use tables of calibration data for all commonly used base-metal and rare-metal thermocouples.

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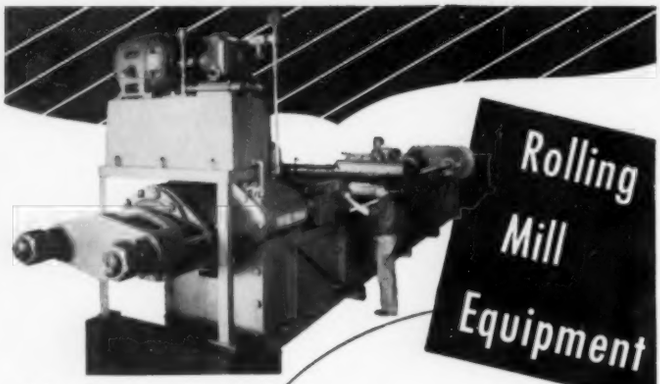

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- Pinion Stands
- Roller Tables
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- Stretcher Levellers
- Guillotine Shears
- Sheet Mill Shears
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Outstanding in quality and in performance Hyde Park Rolling Mill Equipment has enjoyed the respect of the industry for more than fifty years.

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RED CIRCLE Rolls ALLOY-CHILLED
FOUNDRY & MACHINE CO.
Hyde Park, Westmoreland County, Pa.
ROLLS • ROLLING MILL MACHINERY • GREY IRON CASTINGS

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THE *BEST KNOWN NAME* in the GEAR BUSINESS!

We're tooled up to handle your orders for small or large runs of all types of Gears, Sprockets and Splining, including Herringbone Gears up to 61" diameter with 18" face.

We furnish them "Heat-Treated" to suit your service . . . Steel Mill Type or otherwise—"cut only" from your stock or "furnished complete."

Large, Modern Daylight plant where personal service hasn't been lost sight of.

Tell us your requirements. We're on the Beam to help you.

Industrial Gear Mfg. Co.
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CHICAGO 24, ILL.

Thomas A. Jones was elected president of the W. A. Jones Foundry & Machine Co., Chicago, Ill. At the same time **Frederick H. Hoge,** became chairman of the board. **Robert B. Moir** is now vice president in charge of engineering, **Joseph A. Marland,** vice president and manager of sales and service, **James B. Christerson,** vice president and treasurer, **Robert E. Whiteway,** secretary and production manager.

James L. Everett has been appointed administrative assistant to the general manager of Dravo Corp.'s engineering works division. Previously he served in the same capacity with that division's contract manager.

W. J. Langacher was appointed chief engineer and

W. J. LANGACHER

G. E. Mandry as assistant chief engineer of the pipe and tube division of Aetna-Standard Engineering Co.,

G. E. MANDRY

Pittsburgh, Pa. Mr. Langacher succeeds Perry J. Snyder, who has resigned to accept a position with Youngstown Sheet & Tube Co.

James M. Walton has been appointed plant industrial engineer for the Midland, Pa., works of Crucible Steel Co. of America. For the past twelve years Mr. Walton has been associated with the Homestead district works of the United States Steel Co.

Francis Juraschek was named assistant director of distribution and availability and **Albert A. Monnett,**

OVER 90 YEARS
LEWIS
OF ROLL MAKING

All LEWIS ROLLS bear this mark* of perfection

MOLYBDENUM CHILLED IRON ROLLS

ATLAS AND ATLAS "B" ROLLS

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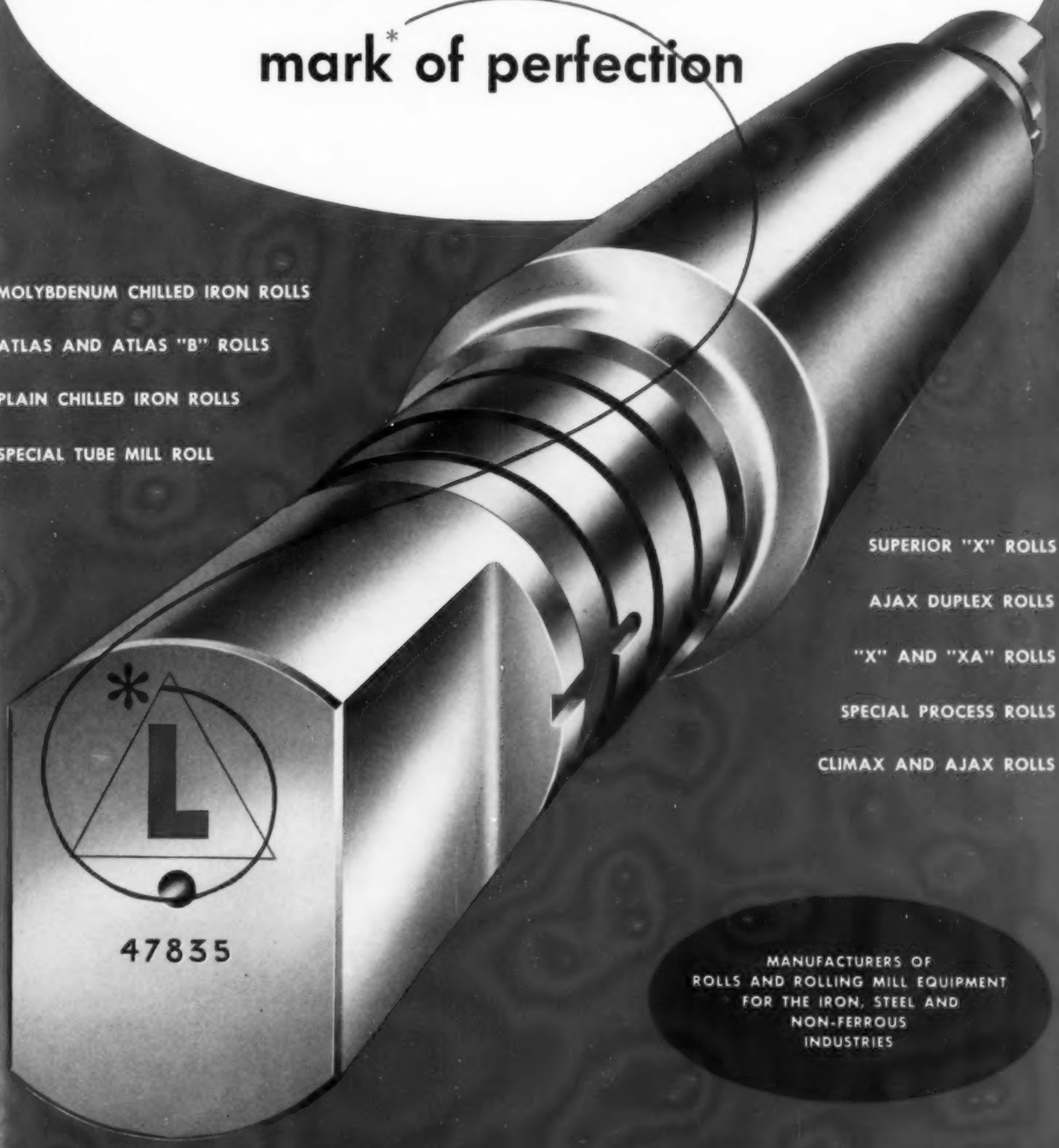
SPECIAL TUBE MILL ROLL



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FOR THE IRON, STEEL AND
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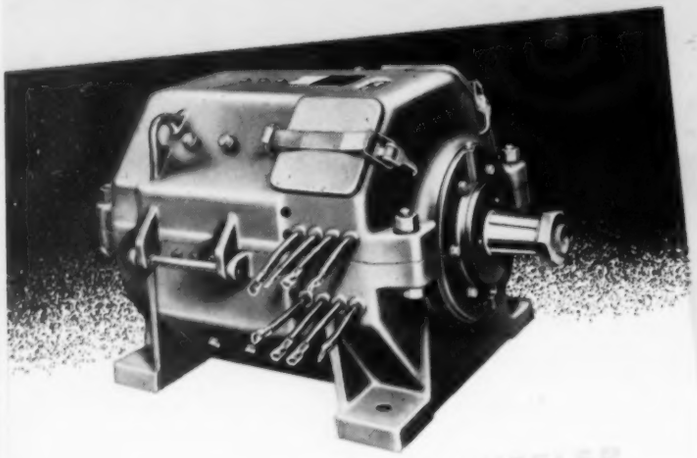
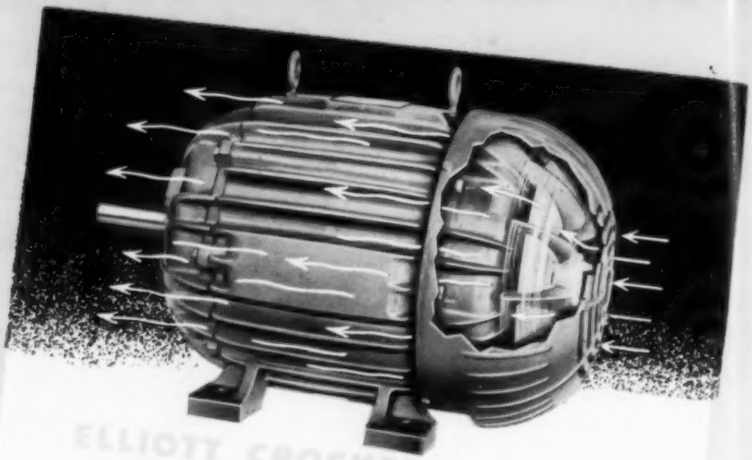
LEWIS FOUNDRY AND MACHINE DIVISION OF BLAW-KNOX CO., PITTSBURGH, PA.



600 Series MILL MOTOR

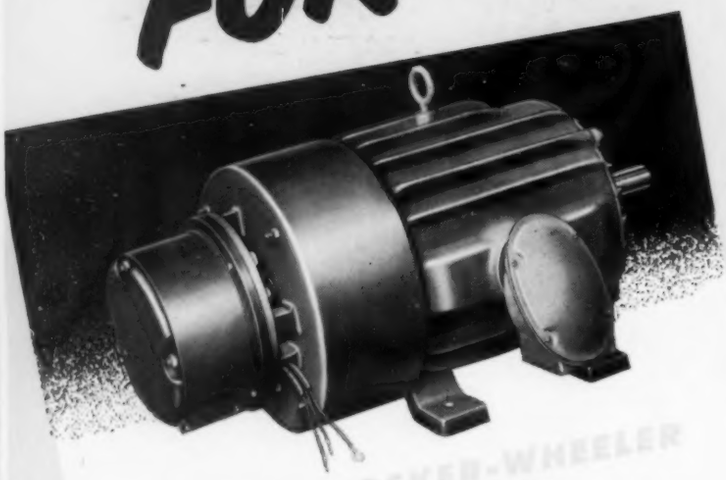
■ As sturdy and reliable as it looks, and packing as much as 33-1/3% more power in each standard size frame. For heavy duty mill and crane service in 5 to 265 hp. Also available in the following modified forms: separately forced ventilated—protected self-ventilated —back geared. Write for the Mill Motor Bulletin.



SEALEDPOWER MOTOR

■ A T.E.F.C. induction motor that both cools and cleans itself by a constant stream of fan-driven air directed along the outside of the finned case. Reliability amply proved by ten years of successful applications under most trying conditions. In 3 to 125 hp. Also available in vertical type, and in explosion-proof underwriter's approved, 20 to 125 hp. Ask for the Sealedpower Bulletin.

TOUGH MOTORS FOR TOUGH JOBS!



BRAKE MOTOR

■ The C-W disc brake is exceptionally compact, requiring a minimum of bulk with relation to its stopping power. Brake linings are of bonded metal, unaffected by temperature, dampness, salt water, fungi, grease or oil. Powerful springs, compressed by magnets, are released the instant power is shut off the motor, and force the heavy armature plate against the discs. Spring pressure can be adjusted by screws from the outside of the case. The brake is shown above mounted on the SEALEDPOWER motor, providing a compact, eminently reliable and enduring unit. Write for the Brake Motor Bulletin.

...Three ELLIOTT CROCKER-WHEELER Motors

designed for high performance under particularly rugged conditions!

Crocker-Wheeler motors range from 1 to 200 hp. Larger Elliott motors and generators are built by the Ridgway Division of Elliott Company in Ridgway, Pa.

ELLIOTT COMPANY

Crocker-Wheeler Division

Ampere, N. J.

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ELLIOTT *Approved* SERVICE SHOPS COVER THE COUNTRY

CW-33

Jr., was appointed assistant director of commercial research (markets) in the commercial department of United States Steel Co., Pittsburgh, Pa.

Robert A. McClure was named assistant to the general superintendent, manufacturing at Homestead, Pa., district works of U. S. Steel Co. Mr. McClure had been at the Vandergrift plant and Irvin works prior to coming to the Homestead plant where he had been assistant division superintendent, slabbing and plate mills. **John W. Price, Jr.,** succeeds Mr. McClure as assistant division superintendent, slabbing and plate mills. **Shirley M. Leavitt** becomes assistant to the general superintendent, costs. **Roy Gilliland** succeeds Mr. Leavitt as plant industrial engineer.

J. D. Greensward has been appointed manager of a newly organized apparatus department at Allis-Chalmers Manufacturing Co., Milwaukee, Wisc. Mr. Greensward continues as general manager of the concern's Norwood works, a position he has occupied since June, 1949. Prior to that he served in an executive capacity in the company's West Allis works. He has been with Allis-Chalmers since 1922.

H. W. Poole has been named manager of engineering in the newly formed industry control department of

H. W. POOLE

General Electric Co., Schenectady, N. Y. Mr. Poole had been manager of the steel mill section since 1946.

Robert H. Brinker, previously with the Cleveland, Ohio, office of Yoder Co. has been placed in charge of a newly opened office in New York, N. Y., at 11 West 42nd Street. His office will handle sales in New England, southern New York and Atlantic Coast territory down to and including Washington, D. C.

Sabel E. Baum, Dixie Engineering Co., Birmingham, Ala., has been appointed district representative for Dollinger Corp., of Rochester, N. Y., in Alabama, western Florida and Marion, Hamilton, Bradley and Polk Counties, Tenn.

William G. Schulze was appointed superintendent of coke ovens–by-products at Kaiser Steel Corp., Fontana, Calif. **C. F. Benninghoff** succeeded Mr. Schulze as assistant superintendent, coke ovens–by-products. Mr. Benninghoff was formerly general foreman in by-products.

William Siebenmorgen has been named consultant for Speer Carbon Co., St. Marys, Pa. Mr. Siebenmorgen

HAVE YOU HEARD ABOUT THIS NEW METAL CLEANER?
IT CAN SAVE MONEY FOR YOU
New metal cleaner removes oil and rust in one operation

Oakite Compound No. 33 removes oil *at the same time* that it removes rust. And *at the same time,* it prepares metal for painting.

It's a great soak cleaner for steel, cast iron and aluminum; and great for hand-swabbing on metal surfaces too large to be soaked in tanks. *It frequently eliminates pickling operations on moderately rusty steel.*

FREE For a copy of Folder F7993 *"New metal cleaner removes oil and rust in one operation",* write to Oakite Products, Inc., 19G Thames St., New York 6, N. Y.

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Whether you want to improve your Roadway, Parking Lot, Track or Dock Lighting — or utilize Searchlights or Fresnel Floods for Fence and Boundary Protection—and/or improve the lighting of your Craneways, Fixed Work Positions, Inspection Departments, etc. REVERE offers specific units to do an efficient job.
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INDOOR & OUTDOOR LIGHTING FOR EVERY NEED

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Standard brushes have been solving commutation problems for a quarter of a century on applications small and large. We have the research and engineering facilities necessary for the proper evaluation of your specific need.

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BRUSHES for Rotary Converters • Synchronous Motors • Mill and Crane Motors • Mining Machinery Motors • Large Rolling Mill Equipment • Plating Generators • Everything in the fractional line.

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ELECTRODES Up to 6" Diameter and 40" Long

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Specializing in . . . .

BLAST FURNACE STOVE CLEANING

▲

SEWER CLEANING

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WATER AND GAS LINE CLEANING FOR THE STEEL INDUSTRIES

▲

ROBINSON

PIPE CLEANING CORPORATION

McNARY BUILDING 63 WEST PIKE STREET

PHONE: CANONSBURG 2629

CANONSBURG, PA.

is located at 22 Tanglewood Lane, Westfield, N. J. Robert J. Siebenmorgen is sales engineer for Speer, responsible for the eastern district.

A. L. Jones has been appointed manager of the water treating division of Worthington Corp. Formerly manager of the sale of water treating and deaerator section of the steam power division, Mr. Jones will now be in charge of sales, engineering, production and service of water treating equipment.

C. H. Schwerin has been named manager of sales and sales engineering for George J. Hagan Co., Pitts-

C. H. SCHWERIN

burgh, Pa. Mr. Schwerin has been with this company since 1935 in various engineering, erection and sales capacities.

Otto G. Schwenk has been named vice president in charge of industrial products for Blaw-Knox Co.,

OTTO G. SCHWENK

Pittsburgh, Pa. This is a new position created within the company, and Mr. Schwenk will have executive responsibilities connected with the manufacturing divisions of this company. Mr. Schwenk comes to Blaw-Knox from Yale & Towne Manufacturing Co., New York, N. Y., where he has been vice president in charge of production and a director. Prior to his association with Yale & Towne in 1948, he was for four years connected with the Weatherhead Co., Cleveland, Ohio, where he served successively as industrial engineer,

These Metalworking Methods Save Time and Money

These six methods for keeping production geared to current demands are typical of the many processes and products available through LINDE. Not shown, but equally available to LINDE customers, is the invaluable combination of knowledge, technical skills, and wide practical experience that makes such developments possible.

Whatever you do with metals, there is a good chance that LINDE know-how, show-how, and equipment can help you do it better, quicker, or cheaper. Telephone or write our nearest office today.

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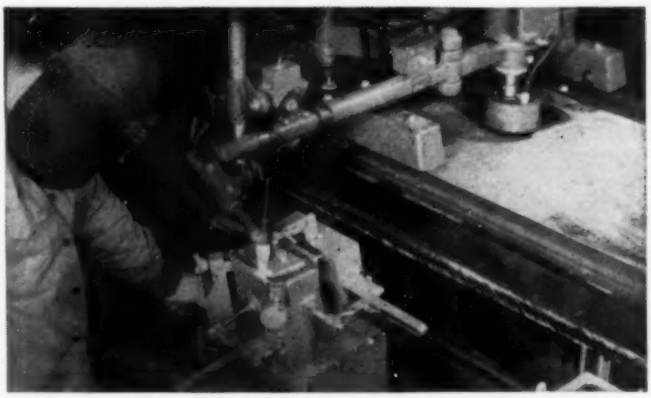
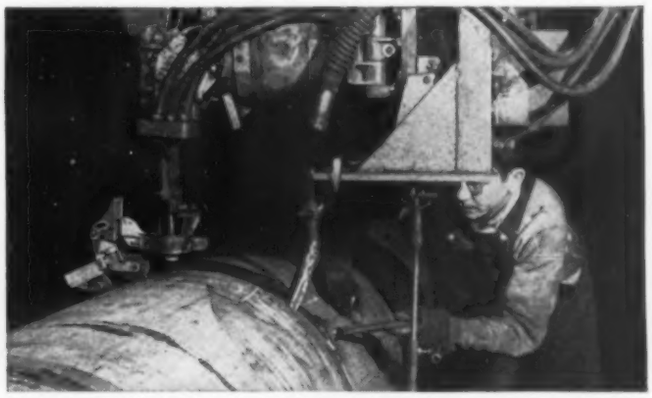
(Left) Flame-hardening gives added service life to parts by providing a hard, wear-resisting surface on a tough, ductile core. (Right) Oxygen-cutting equipment easily slices steel up to 60 in. thick. A 30-in. cut through this 45-in. thick ingot took only 15 minutes.



HELIARC welding in a protective shield of argon or helium gas easily joins hard-to-weld metals such as aluminum, magnesium, stainless steel, and copper alloys. Absence of flux and spatter reduces cleanup and finishing costs.



UNIONMELT welding, a mechanized electric process, joins metals of any thickness without sparks, spatter, smoke, or flash. Welding speeds as much as twenty times greater than by other similarly applicable methods are common.

Powder-scarfing halves conditioning costs on stainless steel. One 8-hr. shift, using two blowpipes, easily powder-scarfs 22 to 24 ingots of 1,000 lb. each.

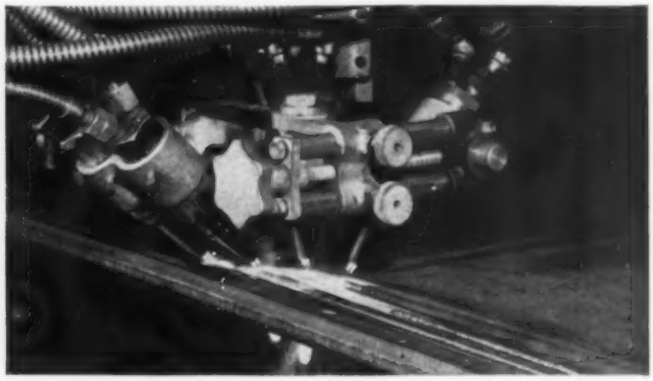


Plate-edge preparation with OXWELD apparatus makes it possible to cut steel plate to size and bevel the edges for welding in one, quick, oxygen-cutting operation.

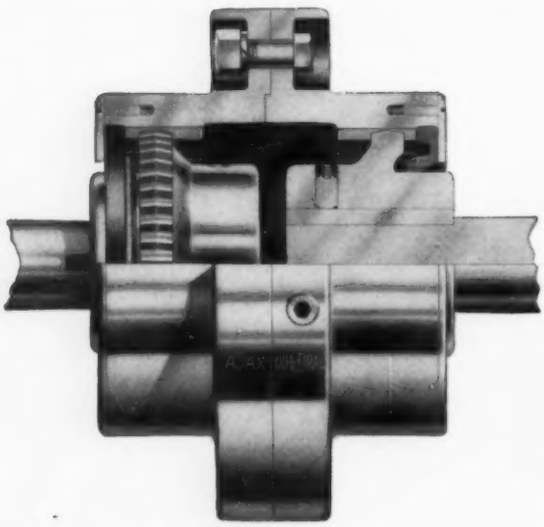
Linde
Trade-Mark

Products and Processes for MAKING, CUTTING, JOINING, TREATING, AND FORMING METALS

The terms "Heliarc," "Linde," "Oxweld," and "Unionmelt" are registered trade-marks of Union Carbide and Carbon Corporation.

AJAX DIHEDRAL

New Coupling STEEL MEN Have Waited For



▶ Ability of Ajax Dihedral Couplings to handle extreme misalignment is the talk of hard-boiled steel men everywhere.

Exclusive Dihedral tooth shape provides for misalignment up to 4 degrees as stock off-the-shelf couplings. 6, 8, 10 and 12 degree teeth cut to order.

Save costly hours of setup, change-over and maintenance time. Line up motors in minutes not hours.

Write for facts on this radically new and exclusive coupling.

AJAX FLEXIBLE COUPLING CO. INC.
WESTFIELD, NEW YORK

controller, production manager, and executive assistant to the president.

Ray M. Schneider was named eastern machinery manager for Medart Co. Mr. Schneider will be located at Titzel Engineering Co., 132 Seventh Street, Pittsburgh, Pa. Titzel Engineering will continue as Medart representative in the Pittsburgh, Pa. area.

Arthur J. Buckley was named assistant sales manager of Pangborn Corp., Hagerstown, Md. For the past eleven years, Mr. Buckley was associated with the Harnischfeger Corp., Milwaukee, Wisc., in both home-office and field sales work.

W. S. Richardson, formerly field engineer, Electric Controller & Manufacturing Co., Pittsburgh, Pa., has entered into partnership with **L. E. Albrecht,** manufacturers' representative, trading under the name of Albrecht & Richardson, with offices at 510 Union Trust Building, Pittsburgh 19, Pa.

Phil Sprague, Jr. has been appointed executive vice president of Hays Corp., Michigan City, Ind. **Paul B. LeBoeuf** has been named to succeed Mr. Sprague as advertising manager. Mr. LeBoeuf comes to Hays from the A. O. Smith Corp.

Obituaries

Walter J. Mullaly, sales representative, American Manganese Steel division, American Brake Shoe Co., Chicago Heights, Ill., died recently.

Harry E. Einert, president of Cyrus Wm. Rice and Co., Inc., Pittsburgh, Pa., died February 11.

Hot Blast VALVE SEATS

Bosh Plates
Mantle Plates
Cinder Notches
Tuyeres
Tuyere Coolers
Hot Blast Valves
and Valve Seats

Dependability and Long Service at no Extra Cost

Smeeth-Harwood moulding and melting techniques, perfected through the years, produce dense castings, free of blow holes, and of uniform wall thickness.

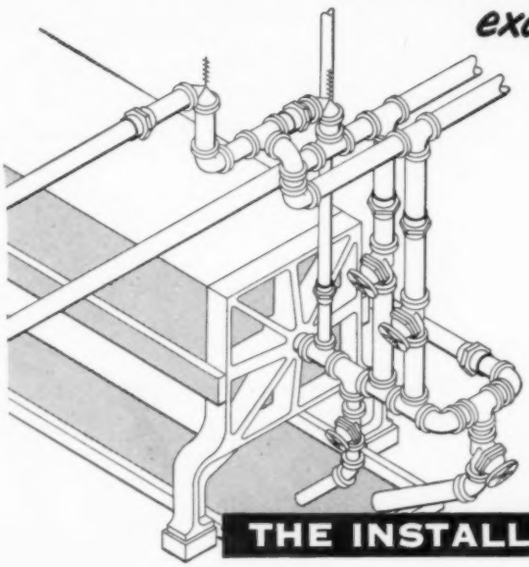
The superior quality assures longer, more dependable service at no extra cost.

RESULTS TALK—Place your next order for Valve Seats with us and compare performance.

SMEETH-HARWOOD COMPANY
2401-09 West Cermak Road, Chicago 8, Illinois
Superior Blast Furnace Copper Castings Exclusively

Do Your Valves Last This Long?

...on Semi-Solids, for example



THE INSTALLATION

Crane Packless Diaphragm Valves handling liquid clay to filter presses. Onondaga Pottery Co., Syracuse.

VALVE SERVICE RATINGS

SUITABILITY: Fluid can't get into working parts

MAINTENANCE COST: None yet – Big savings indicated

CORROSION-RESISTANCE: Excellent

SERVICE LIFE: 5 times longer already – no sign of wear

OPERATING RESULTS: No interruptions – Easier operation – Lower cost

PRICE: Good

AVAILABILITY: Stock item – Crane

THE HISTORY

Plug cocks were used in this service before replacing with Crane Diaphragm Valves. But the cocks lasted no more than 2 to 8 weeks. They quickly cut out at the plug and body, damaged by the gritty particles and highly erosive effects of liquid clay at 140 psi. pressure.

After 11 months' uninterrupted service, Crane Diaphragm Valves showed no significant wear or damage resulting from normal operating conditions. They sharply reduced maintenance and replacement costs over plug cocks, and were approved as standard equipment on filter press piping.

THE VALVE

In Crane Iron Body Packless Diaphragm Valves, the Neoprene diaphragm acts as bonnet seal only; is not subject to crushing and rapid wear. Separate disc with Neoprene insert shuts off flow even should diaphragm fail. Choice of fully Neoprene lined or unlined valves. Highly recommended for many common and corrosive services; sludges, slurries, etc. See your Crane Catalog or Crane Representative.

The Complete Crane Line Meets All Valve Needs. That's Why

More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois

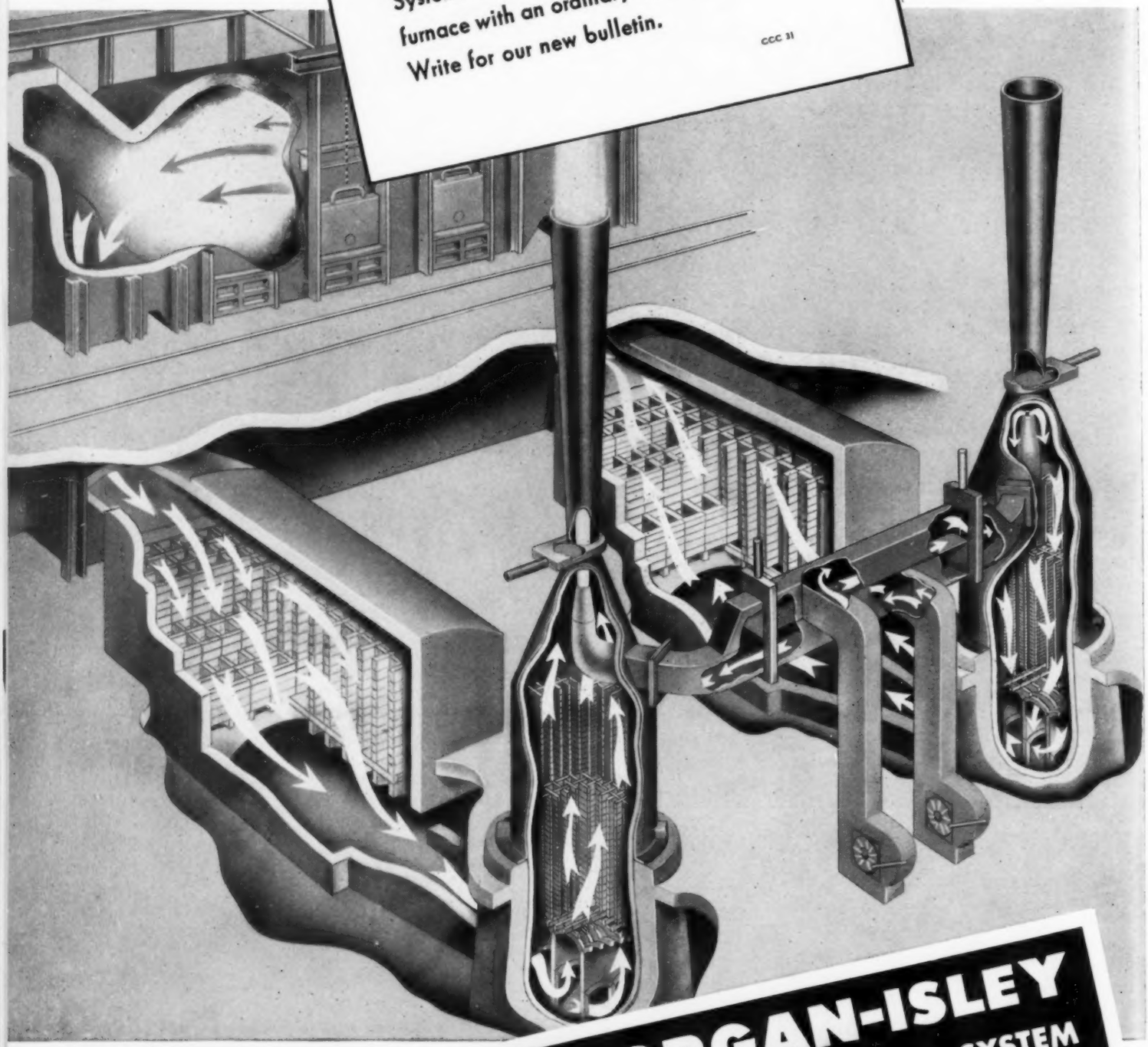
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

How would you like to reduce fuel consumption more than 15% and at the same time increase production more than 12%? This has been done with a Morgan-Isley System ... operating alongside a duplicate furnace with an ordinary natural draft system. Write for our new bulletin.

CCC 31

MORGAN WORCESTER



MORGAN-ISLEY COMBUSTION CONTROL SYSTEM

MORGAN CONSTRUCTION CO.

WORCESTER, MASSACHUSETTS

PITTSBURGH, PA., 2815 Koppers Building

English Representative,
International Construction Company, 56 Kingsway, London W. C. 2, England

ROLLING MILLS - MORGOIL BEARINGS - REGENERATIVE FURNACE CONTROL - EJECTORS - WIRE MILLS - GAS PRODUCERS

...for an impartial decision

What type bearing is best suited to your needs... Straight Roller... Tapered Roller... Spherical Roller... or some other type?

You can be sure of an impartial decision from Torrington which makes *every* type of anti-friction bearing. In addition, Torrington engineers have had broad experience in applying anti-friction bearings to virtually every type of equipment —from household appliances to steel mill machinery.

This experience and an understanding of customers' problems have proved beneficial to many manufacturers. Why not ask a Torrington engineer to help with *your* next problem?

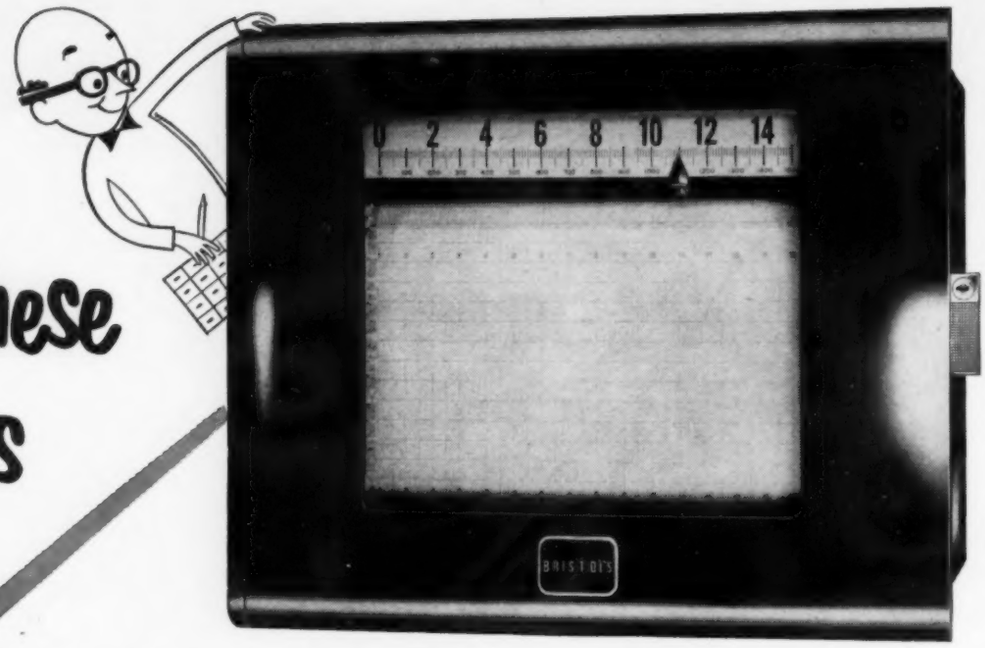
THE TORRINGTON COMPANY

South Bend 21, Ind. Torrington, Conn.

District Offices and Distributors in Principal Cities of United States and Canada

TORRINGTON BEARINGS

Spherical Roller • Tapered Roller • Straight Roller • Needle • Ball • Needle Rollers



Check these features OF THE BRISTOL DYNAMASTER

—the electronic master-mind for your temperature measuring, recording and controlling problems

✓ Continuous-balancing electronic circuit responds instantly to minute changes

✓ All types of electric and air-operated controllers offered

✓ Available as a self-balancing bridge or potentiometer

✓ Trouble-free operation

✓ Electronic component uses vacuum tubes available at any radio supply house

✓ Full-scale pen travel in 7, 3 or ⅔ seconds

✓ Chart speeds from ¾ in. per hour to 7200 in. per hour

✓ Multiple recorders up to 16 points

✓ Components interchangeable and easily replaced on all Dynamaster models

✓ Immune to most vibration or shock

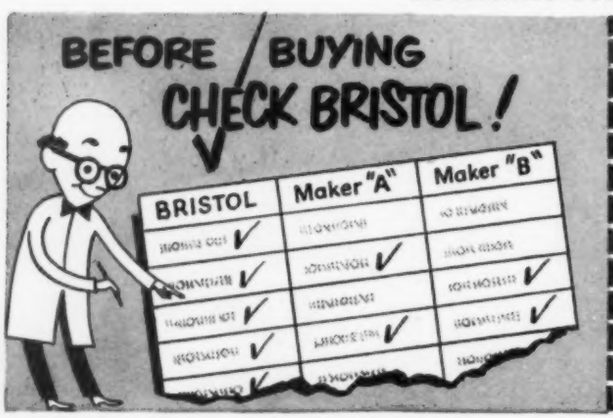
✓ Exceptionally unaffected by stray currents (1000 to 1 discrimination).

BRISTOL

FOR DETAILED PROOF *of the sensitivity, versatility and reliability of the electronic Dynamaster, use the coupon or write for Catalog P1245.*

The dependable Guidepost of Industry

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS



THE BRISTOL COMPANY
123 Bristol Road
BRISTOL, CONNECTICUT

Please send catalog giving details of Dynamaster performance to:

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

LUBRICATION SYSTEMS FOR MILLS OF ALL SIZES

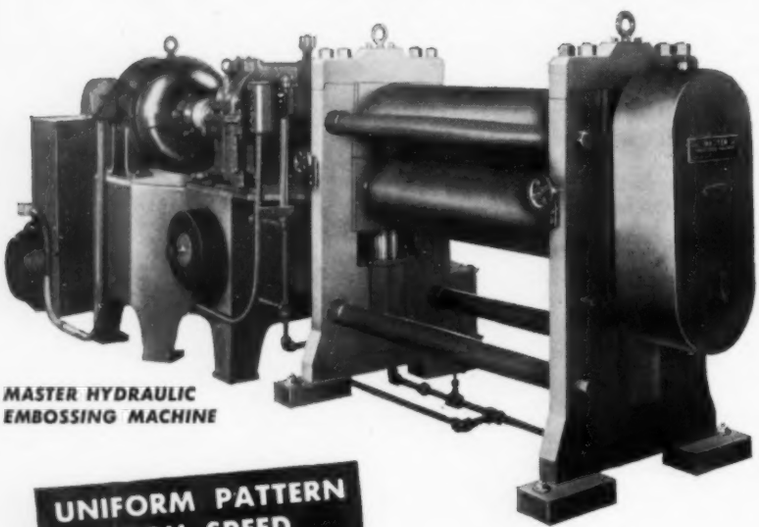
In all mills, large or small, De Laval Lubrication Systems are completely engineered. They all include proper selection of pipe size, the correct metering of the lubricant, the proper control of temperature and purification of the lubricating oil. Other features of De Laval Engineered Lubrication Systems include the manner in which the lubricants are applied, the way the lubricant is metered (with a pre-calculated excess for cooling) and efficient temperature control.

THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York 427 Randolph St., Chicago 6
DE LAVAL SALES & SERVICE, INC.
447 Fourth Ave., Pittsburgh 19
DE LAVAL PACIFIC COMPANY
61 Beale St., San Francisco 5

DE LAVAL
ENGINEERED SYSTEMS

MEET THE METAL WORLD OF TOMORROW
Ahead of Competition

With the GREATEST Development in History for Embossing and Finishing Sheet and Coiled Strip



MASTER HYDRAULIC EMBOSSING MACHINE

U. S. Patent Pending

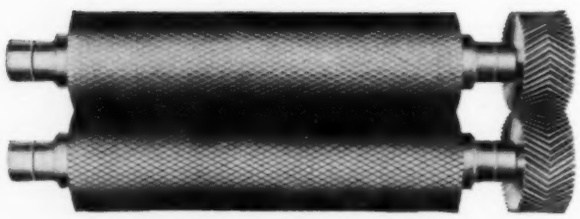
UNIFORM PATTERN HIGH SPEED LOW COST

MASTER *Hydraulic* EMBOSSING MACHINE

with

ENGRAVED MATCHED HARDENED FORGED STEEL ROLLS

- *Produces a wide variety of prefabricated finishes*
- *Makes light gauge metals rigid and stronger*
- *Localized embossing and cold rolling in one operation*
- *Many installations now in operation*



ENGRAVED MATCHED HARDENED FORGED STEEL ROLLS

U. S. Patent Pending

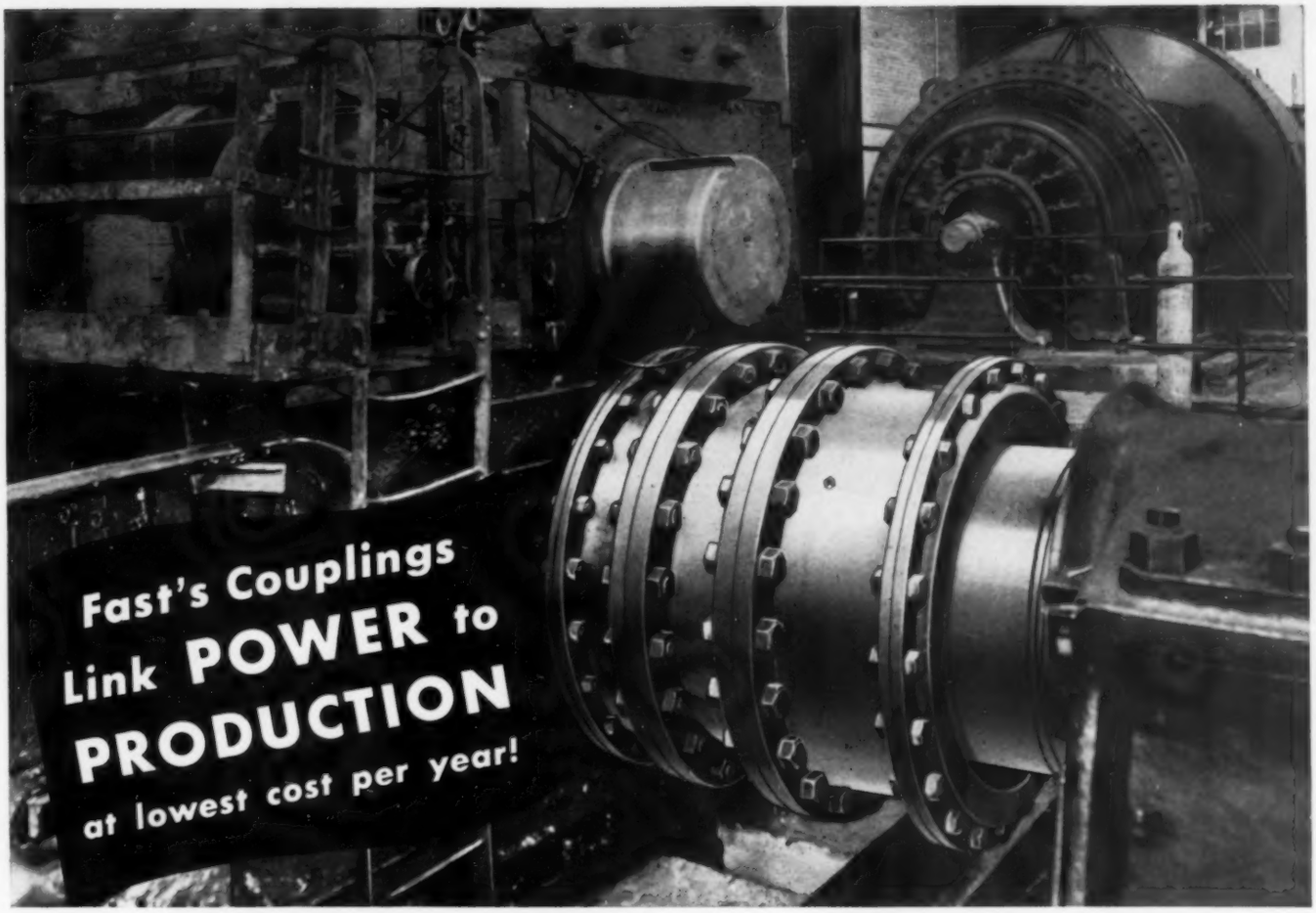
Be Ready to Serve Your Customers Ahead of Competition

Write TODAY for Details!

MODERN ENGRAVING & MACHINE CO.

1413 CHESTNUT AVE., HILLSIDE 5, NEW JERSEY

COPYRIGHT 1952 MODERN ENGRAVING & MACHINE CO



FAST'S Couplings usually outlast the equipment they connect!

ACTUAL cases on record show many Fast's Couplings are still in service after as much as 30 years of continuous operation! Time and time again, equipment has been replaced while the original Fast's Couplings remained on the job.

To you, these records of dependable, trouble-free service mean freedom from costly coupling failures when you specify Fast's. And they mean Fast's cost you far less to own and operate . . . because their cost can be amortized over long years of dependable performance.

For full details on how Fast's Couplings and Koppers Engineering Service can help you, write today for a free copy of our catalog to: KOPPERS COMPANY, INC., *Fast's Coupling Dept.,* 212 Scott St., Baltimore 3, Maryland.

Here's How FAST'S Save You Money

Free Service—Koppers free engineering service assures you the right coupling for the job.

Rugged Construction—Fast's still maintains its original design, without basic change or sacrifice in size or materials. Result: freedom from expensive coupling failures.

Lowest Cost per Year—Fast's Couplings usually outlast equipment they connect. Their cost may be spread over many years!

KOPPERS®

FAST'S
THE ORIGINAL
GEAR-TYPE
Couplings

INDUSTRY'S STANDARD FOR 32 YEARS

KOPPERS COMPANY, INC., *Fast's Coupling Dept.,*
214 Scott St., Baltimore 3, Md.

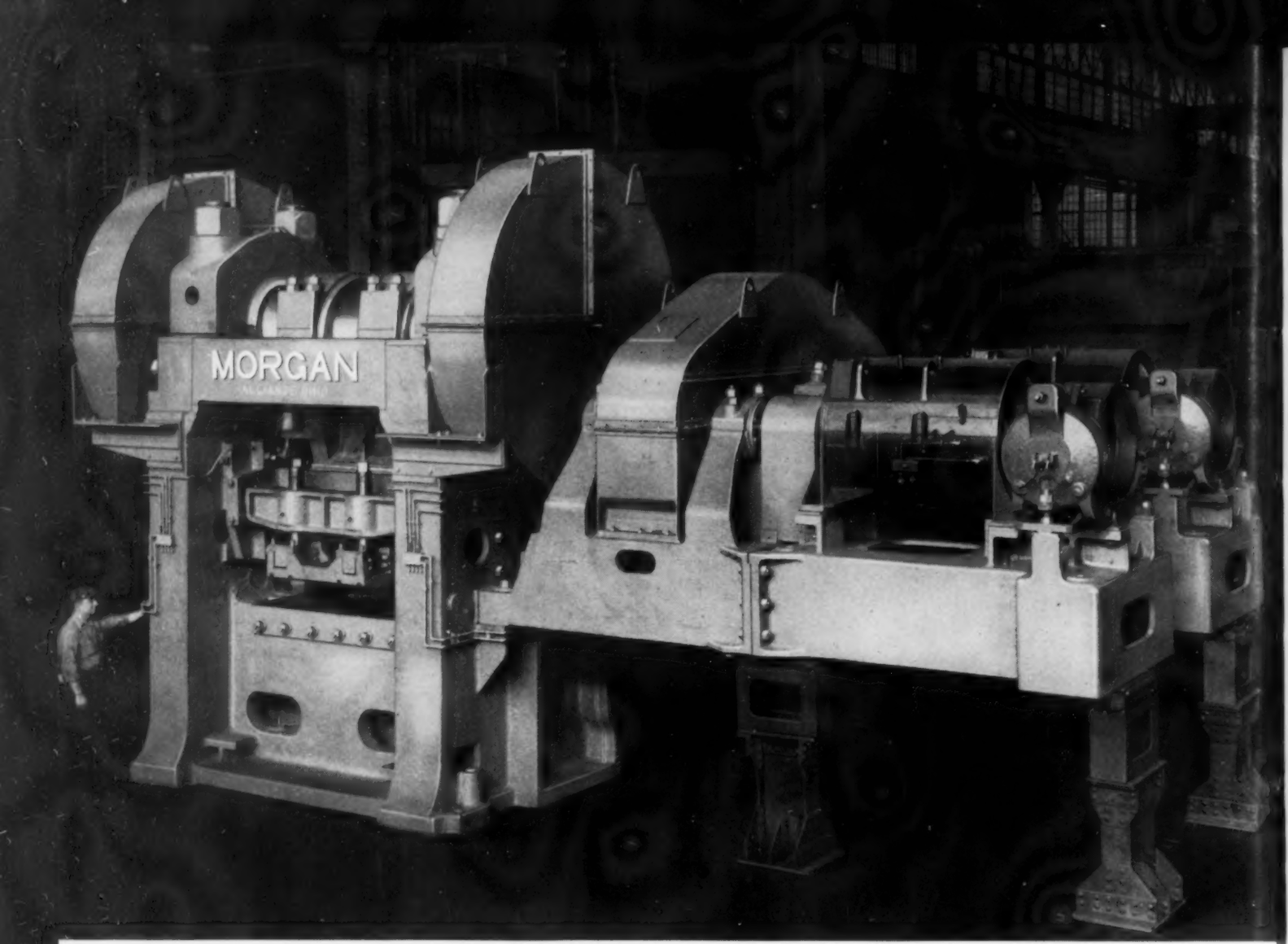
Gentlemen: Send me Fast's Catalog which gives detailed descriptions, engineering drawings, capacity tables and photographs.

*Name*_____

*Company*_____

*Address*_____

*City*_____ *Zone*____ *State*_____



1200-TON DOWN CUT SLAB SHEAR

BUILT BY MORGAN Engineering

DESIGNERS • MANUFACTURERS • CONTRACTORS

BLOOMING MILLS • PLATE MILLS • STRUCTURAL MILLS

ELECTRIC TRAVELING CRANES • CHARGING MACHINES

INGOT STRIPPING MACHINES • SOAKING PIT CRANES

ELECTRIC WELDED FABRICATION • LADLE CRANES

STEAM HAMMERS • STEAM HYDRAULIC FORGING PRESSES

SPECIAL MACHINERY FOR STEEL MILLS

THE MORGAN ENGINEERING CO.

ALLIANCE, OHIO PITTSBURGH—1420 OLIVER BUILDING

Illustrated is a 1200-ton hot Slab Shear of the start-stop type with twin-motor drive.

Shear has a 12″ stroke. Designed to cut maximum 51″ wide x 6″ thick stainless steel and 60″ wide x 7″ thick carbon steel slabs.

Cutting speed eight (8) strokes per minute.

Your inquiries for mill equipment will be appreciated.

Equipment News...

ARMOR PLATE

▲ Crucible Steel Co. of America, which produced armor-piercing shells for the Army and Navy during World Wars I and II, is working on the reverse problem in the current defense build-up—steel armor plate that will resist shells.

The specialty steel company's Spaulding plant in Harrison, N. J. is turning out a high-quality, heat-treated ballistic armor casting of low alloy steel for use on U. S. Army tanks.

Working from Army Ordnance specifications, the company recently submitted its armor plate for qualification tests at the Aberdeen Proving Grounds, Maryland. Crucible officials were notified that the first special steel casting submitted for test had met Ordnance requirements, and that quantity production and shipments could start. Crucible will also act as subcontractor for a number of other small cast armor parts for the army tanks.

The tank steel is subjected to special processes to produce high impact-resistance. This method of production is closely related to that used in the manufacture of high quality special purpose steels.

The Spaulding works, one of the five Crucible plants, specializes in the production of high quality steels and alloys used in the manufacture of tools, industrial machinery and aircraft. It is a large producer of permanent magnets used in making radio, television and radar equipment and its cold-rolled department is a leader in the manufacture of stainless cutlery steels.

UNIT PILLOW BLOCK

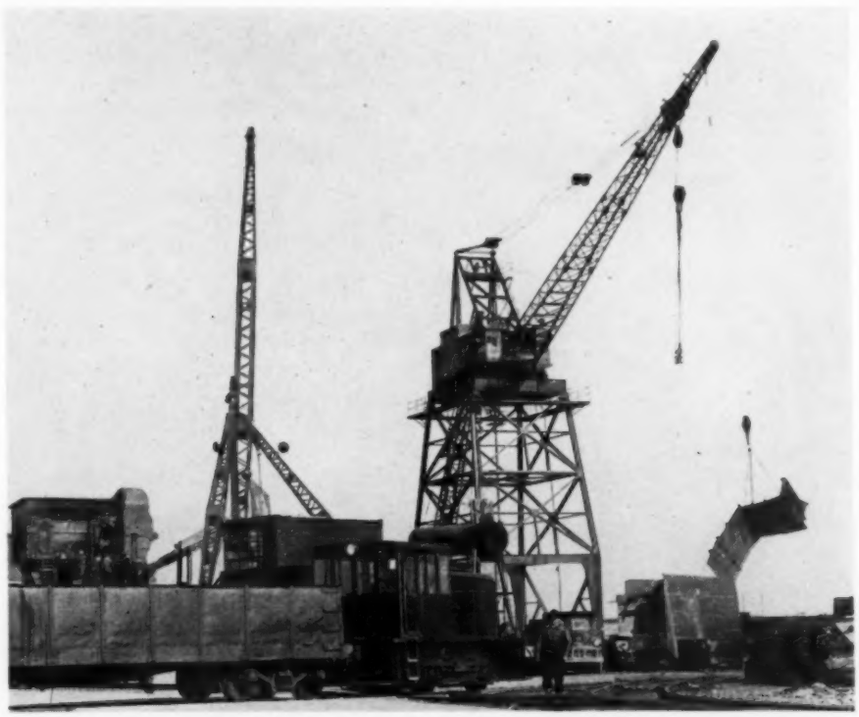
▲ An improved unit pillow block, with a lubricant-retaining "Fairprene" red seal, has been announced by SKF Industries, Inc. Practically frictionless wiping action of the seal against the inner bearing ring is a feature of the new Hess-Bright "SY" unit.

Other features are rotating flingers to exclude dirt, a collar with set screws for easy installation, spherical outer ring compensation for initial misalignment, relubrication through Alemite fitting, and interchangeability with existing installations

The "SY" pillow block was designed for use in conveying, agricultural, chemical, food, ginning and textile machinery; light fans and blowers; light power take-off units and jack shafts, among others.

It eliminates costly machining, is quickly applied, factory-sealed against dirt contamination, requires infrequent lubrication and reduces maintenance costs. Shaft diameters range from 1 3/16 in. to 2 15/16 in.

DIESEL LOCOMOTIVE



Feeding the steady flow of scrap to the nation's steel mills is the business of Northern Metal Co. of Philadelphia, Pa., which specializes in dismantling ships for scrap steel. Above, a General Electric 25-ton diesel-electric locomotive pulls a car into loading position. One hundred per cent available since being put into service in April, 1949, this little switcher has required only $60 maintenance a year.

CHART CONTROLLER

▲ An electronically operated circular chart controller which can control industrial processes according to time-temperature schedules has been developed by Minneapolis-Honeywell Regulator Co.

In instances where both time and temperature control are important for product quality and efficiency of operation, the new instrument—developed by Honeywell's Brown Instruments Division—has an integral-program cam mechanism which automatically positions the instrument control point in accordance with a predetermined program.

This instrument combines within a single case, measurement and recording on a 12-in. chart; automatic positioning of the set point index as directed by a transparent program cam; and automatic program control of the variable.

The combination of these functions in a single instrument has resulted in economy not previously available when it has been necessary to use another instrument or devices separate from the controller.

The standard Brown continuous balance system is used for measure-

for your file....

NORTHERN'S

Latest Bulletins

NORTHERN ENGINEERING WORKS

2615 ATWATER ST. DETROIT 7, MICHIGAN

ment. It is available in both electric and pneumatic control.

An adjustable micro switch assembly, operated by the cam, is optionally available. The switch assembly is used to de-energize the cam drive motor, shut down equipment, operate signal lights or perform other electrical functions at the user's option.

HYDRAULIC "AUTOPOUR"

▲ Blaw-Knox Co. announced the availability of the "Autopour," a hydraulic device that enables the teeming of ingots from ladles to be performed by remote "push button" control.

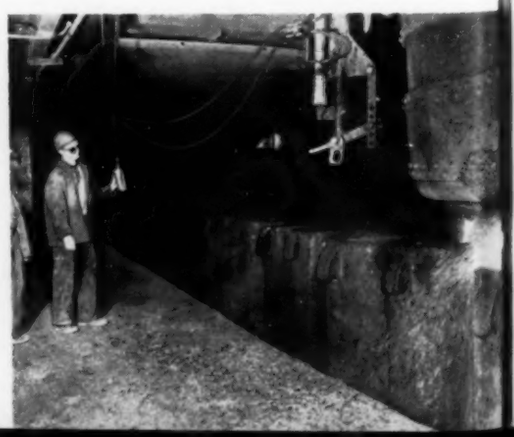
Designed to increase safety and decrease manual labor, the "Autopour" is reported to contribute to quality improvement as well. The device was originally developed by Republic Steel Corp. and is now made and sold by the Steel Plant Equipment Department of Blaw-Knox Co.

The "Autopour" replaces the conventional manual control with controllable hydraulic pressure for both opening and closing the stopper. Since the pressure is limited only by the physical strength of the stopper rigging, greater opening and closing force can be exerted. Leakers and dribbles are thus minimized and sticking stoppers are reduced. (An adjustable pressure relief valve can be set so that the force cannot exceed the safe operating pressure for any given ladle rigging.)

Some of the plants that have used "Autopour" have increased their good pours by 10 per cent or more. To the extent that surface quality is affected by pouring practice, this improvement in pouring performance through the use of the "Autopour" should logically improve quality.

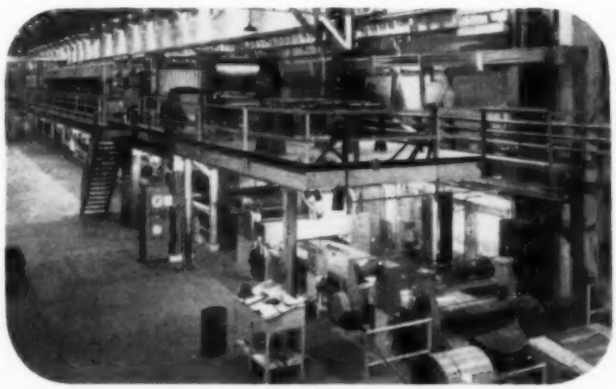
The hydraulic control is both sensitive and accurate; the opening can be barely cracked or opened to any

The illustration shows the use of the "Autopour" in the teeming of ingots at a district steel plant.



Galvanizing
Aluminizing
Bright Annealing and
Normalizing Strip ------ Continuously

Strip in single or multiple strands up to a total width of 54" may be bright annealed or normalized, continuously, in this EF gas fired radiant tube installation. Capacity 7200 lbs per hour.



A large capacity continuous strip normalizing, annealing and galvanizing unit. This is a combination EF gas fired radiant tube and electrically heated installation and is over 400 feet long.

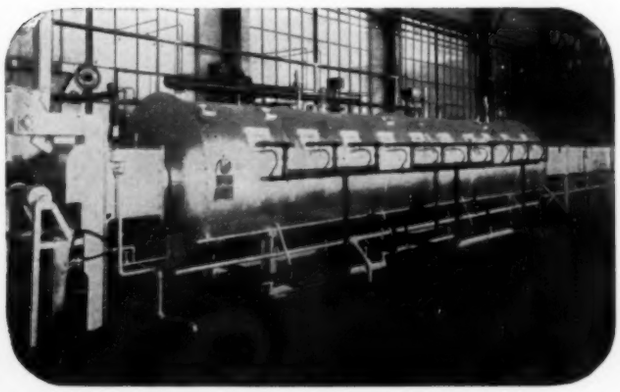
We are in position to design, build and put in operation; continuous strip lines for hot or cold rolled, high or low carbon, stainless, silicon, tinplate, aluminum, brass, bronze or any other ferrous or non-ferrous strip — for bright annealing, normalizing, galvanizing, aluminizing, tinning or any other process — in the size and type best suited to your plant, process, product or production requirements. No job is too large or too unusual.

Put your production furnace problems up to experienced engineers — *it pays.*

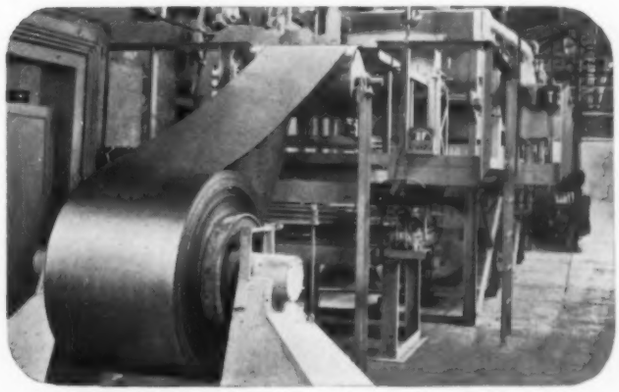
THE ELECTRIC FURNACE CO.

Salem, Ohio

Gas Fired, Oil Fired and Electric Furnaces



Stainless steel strip is bright or process annealed, continuously, in this EF gas fired special atmosphere tube muffle type furnace. It also handles other strip requiring lower temperatures.



An EF special atmosphere furnace with flame preheating burn-off or oxidizing section and controlled heating and cooling zones for producing various surface conditions on strip.

the streamlined answer to steel handling problems...

ROSS STRADDLE CARRIERS + UNIT LOADS

Old concepts of steel handling are fast giving way to this modern method. Why? Because unit loads provide flexibility that cannot be equalled by car-load-lot handling . . . flexibility made possible by wide-ranging ROSS STRADDLE CARRIERS. Self-loading and unloading, these machines require only an operator . . . no locomotive and switching crews . . . no riggers . . . no expensive, space-consuming trackage . . . no endless shuttling of cars. And ROSS Straddle Carriers for steel mills are built like battle ships to give dependable service in tough steel mill operating conditions. Want proof? Just ask mills which have converted to ROSS STRADDLE CARRIERS what *they* think!

Rely On ROSS

THE ROSS CARRIER COMPANY

Direct Factory Branches and Distributors throughout the World

400 MILLER STREET, BENTON HARBOR, MICHIGAN, U. S. A.

extent so that puddling the bottom and topping-off are simplified and improved, and the taking of spoon samples is facilitated.

Safety is increased because the operator can be at a safe distance from the ladle; in one plant, the pouring is done from the crane escape platform. Due to the elimination of manual labor, many heats can be poured in succession without fatigue to the pourer.

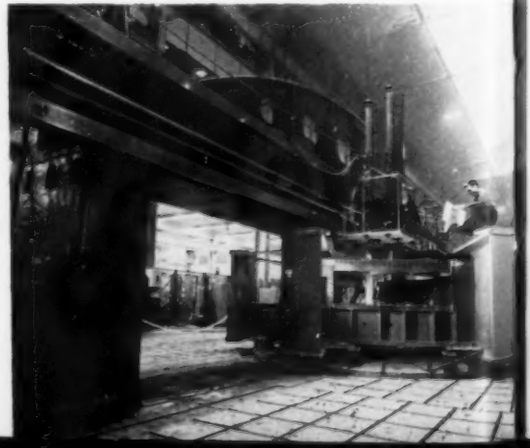
FLOOR MANIPULATOR

▲ An improved wedge action design in the work holding tongs mechanism and a new positive-positioning feature in the tongs shoes of the Brosius auto-floor manipulator assures certainty of grip and maneuverability of hot stock during forging. Designed and built by Salem-Brosius, Inc. these machines come in sizes ranging from 1 to 10 tons carrying capacity. They are designed to handle forging stock from the beginning of the operation through to the end, including loading and drawing furnaces and manipulating the work while in the press. The speed and versatility of handling afforded by the machine assures high speed production cycles, a vital factor when forging aluminum, stainless steel, and other metals with narrow critical forging temperature ranges.

Gasoline, diesel, or electric power, coupled with a rubber tired vehicle, assures adaptability to any type of plant operating requirements. The rotating, tilting, vertical, and lateral motions of the work head guarantees complete control of the work during forging.

PORTABLE BORING MILL

▲ A newly installed 42-ft vertical boring mill, which machines huge hydro-generator frames and bearing bracket assemblies with watch-like precision at the General Electric Co.'s Schenectady works, is one of the



DRIVES *for every power transmission need...*

Whatever your requirements in enclosed gear drives, you will find the one best suited to your needs in the complete Foote Bros. line.

Here are compact gearmotor and speed reduction units, ideal for use on original equipment. Heavy duty worm gear drives designed to stand up under tough service. Helical gear drives available in capacities of over 1500 h.p.

The latest in gear-cutting equipment, newest manufacturing techniques, better control of material—all backed by nearly a century of experience—assure you high quality enclosed gear drives.

Bulletins are available on drives to meet every need. Check the ones you want on the coupon below.

LINE-O-POWER STRAIGHT-LINE DRIVES

Economical in original cost and operation. Duti-Rated Gears have file-hard tooth surfaces and ductile cores, assuring long life. Double or triple reductions, with ratios from 5 to 1 up to 238 to 1 and capacity range from 1 up to 175 horsepower.

FOOTE BROS.—LOUIS ALLIS GEARMOTORS

A compact line of gearmotors in 17 sizes in single, double and triple reductions, incorporating Duti-Rated Gears that assure long wear life and maximum load-carrying capacity. Available with Louis Allis open drip-proof, splash-proof, enclosed and explosion-proof motors.

HYGRADE WORM GEAR DRIVES

Heavy duty drives with precision worm gearing that assures high efficiency and load-carrying capacity. Horizontal, vertical and Hytop (extended shaft) types. Ratios from 4⅛ to 1 up to 4108 to 1. Capacities up to 260 horsepower.

MAXI-POWER HELICAL GEAR DRIVES

Heavy-duty helical gear drives. Available in single reduction units, ratios up to 9.91 to 1; capacities up to 1550 horsepower; double-reduction units, ratios from 9.32 up to 71 to 1, capacities to 1100 horsepower; triple reduction units, ratios from 79 up to 360 to 1, capacities up to 420 horsepower.

WORM-HELICAL GEAR DRIVES

Heavy duty vertical drives with horizontal input shafts and vertical output shafts—up or down. Ratios from approximately 25 to 285 to 1 and a capacity range up to 128 horsepower.

FOOTE BROS.

Better Power Transmission Through Better Gears

FOOTE BROS. GEAR AND MACHINE CORPORATION
4545 South Western Boulevard • Chicago 9, Illinois

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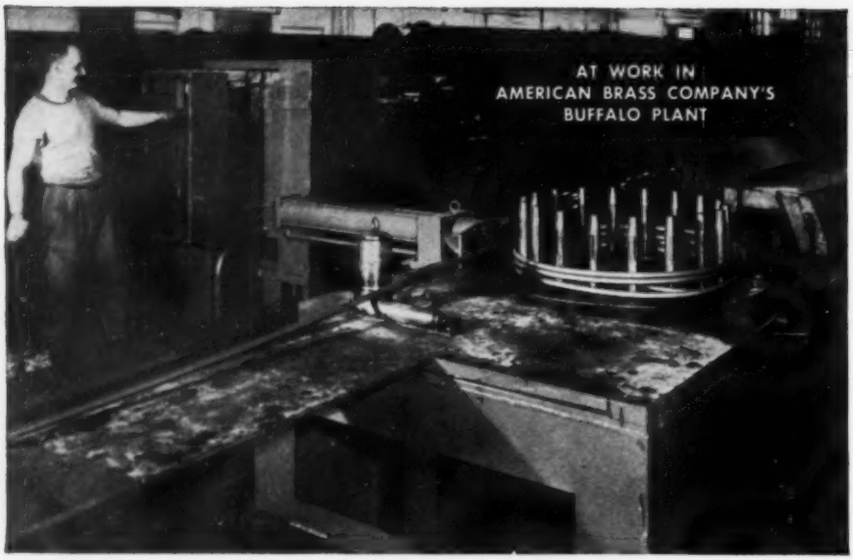
Dept. IAS, 4545 South Western Boulevard, Chicago 9, Illinois

- ☐ Bulletin HGA Hygrade Worm Gear Drives
- ☐ Bulletin LPB Line-O-Power Straight Line Drives
- ☐ Bulletin MPB Maxi-Power Helical Gear Drives
- ☐ Bulletin GMA Foote Bros—Louis Allis Gearmotors
- ☐ Bulletin WHA Worm-Helical Gear Drives

Name.....*Position*.....
Company.....
Address.....
City.....*Zone*.....*State*.....



TORRINGTON #1860 BAR COILER

- *Adjustable, ELECTRONIC control of speed and tension!*
- *Works on standard alternating current!*
- *Speeds from 50 to 400 linear feet per minute!*

If you face the problem of coiling extruded non-ferrous bars of any composition up to 7½" wide and ½" thick, this revolutionary Torrington machine has the features you need:

1. Adjustable automatic *electronic* control of speed and tension, to synchronize with the speed of the bar as it is extruded.
2. Variable speed from standard AC power supply—no expensive DC installation needed.
3. Air-operated ejector pushes finished coil off machine.
4. All parts above table top are arranged for easy removal to provide unobstructed flat working surface or allow extruding straight lengths without interference. Air-powered pins of pin-type coiling reel retract flush to table top.
5. Built to the precision standards for which Torrington machines have been famous for 65 years.

Torrington's decades of experience and knowledge, gained from continuous collaboration with foremost makers and fabricators of metal, are at your service to help you put this revolutionary new Bar Coiler — or any other Torrington special-purpose machine — to profitable use in your plant.

Call or write Torrington for information and name of nearest Torrington representative.

The TORRINGTON

MANUFACTURING COMPANY • TORRINGTON, CONNECTICUT

DESIGNERS AND BUILDERS OF MILL MACHINERY FOR SIXTY-FIVE YEARS

largest known removable rail type mills ever built.

Erected in one of the buildings of the large motor and generator department, this giant mill is shown being prepared to shave curls of tough, high-quality steel from a lower bearing bracket for a large hydro-electric generator.

With its heavy table, measuring 20 ft in diameter, the over-all boring unit is designed to handle a piece 42 ft in diameter. The mill is so constructed that the work can either rotate on the table or stay fixed while a cutter assembly rotates inside the piece. Powered by a 100-hp d-c drive motor, the large mill has a 42-ft cross-rail weighing 70 tons which is removable to allow for the addition of another support which raises the cross-rail half again the height shown here.

Some 100 tons of steel including 18 tons of reinforcing steel, 10 tons of stud material and 70 tons of piling went into the mill foundation. Nearly 700 cu yd of dirt were removed to make way for the massive foundation using 560 cu yd of concrete. The base has an over-all weight of 1134 tons.

GAGE FIRM EXPANDS

▲ The completion of a new research and engineering building has been announced by W. E. Chope, president, Industrial Nucleonics Corp., Columbus, Ohio, manufacturers of the AccuRay beta gage now being used extensively in the rubber, plastics, paper, and metals rolling industries. According to Chope, the expansion of the two departments was dictated by the increased demand of industry for nuclear controls.

The firm's radiochemistry department also will be housed in the new building which is located across the street from the office and production buildings on Chesapeake Avenue. In addition to a large working area in the rear, the building provides office space in front for supervisory personnel.

FURNACE CARS

▲ Twenty-four electric driven furnace cars have been built by Easton Car & Construction Co. for the General Steel Castings Corp. heat treating plant now under construction at Eddystone, Pa. The new plant was designed by the Selas Corp. of

P&H

MILL TYPE CRANES

. . . with all the P&H ADDED VALUES Steel Men want!

Three Gear Case Bridge Drive
delivers motive power to end trucks, perfectly equalized. Mill motor is connected to gear case at center of span, which transmits power equally to the gear cases in front of each end truck.

No Open Gears at Trucks—
gear reductions are completely enclosed in sturdy all-welded cases. All gears run in oil — quietness and long life are insured with all gears operating in oil baths. No exposed gears; no dripping grease.

Flexible Couplings at Wheel Shafts
assure smoother starts — maximum bearing life and prevent thrust from entering gear cases.

Split Gear Cases
are designed to simplify inspection and maintenance.

Large Diameter Cross Shaft
combines maximum strength with low torque to minimize strain.

Hoist Sheaves
readily accessible from trolley deck. All hoist gears, including drum gear and pinion, run in oil.

Trolley Frame
and bridge ends are line bored and milled.

P&H Motors,
brakes and controls are available.

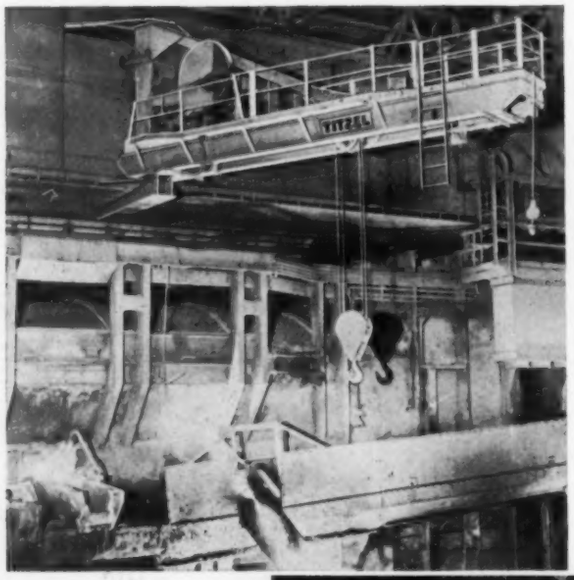
These and many other Added Values explain the preference which accounts for more than 2,000 P&H Cranes in steel mills. P&H Mill Type Cranes are described in Bulletin C-42. Ask for your copy.

P&H
OVERHEAD CRANES
4455 West National Avenue
Milwaukee 14, Wisconsin
HARNISCHFEGER CORPORATION

POWER SHOVELS • CRAWLER AND TRUCK CRANES • OVERHEAD CRANES • HOISTS • ARC WELDERS AND ELECTRODES • SOIL STABILIZERS • DIESEL ENGINES • PRE-FAB HOMES

For dependable, trouble-free operation...

Titzel Steel Mill Equipment

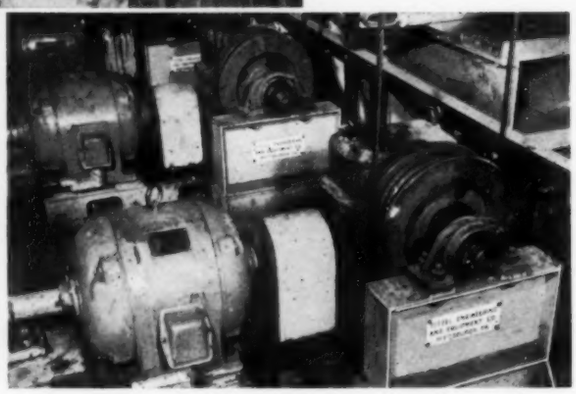


JIB CRANES

Titzel Jib Cranes are built to give maximum service with low cost maintenance. You can depend upon Titzel steel mill equipment to reduce your operational costs and increase your production.

DOOR HOISTS

Titzel Door Hoists give dependable trouble-free operation wherever they are installed. At the right, an installation of Titzel door hoists in the open hearth of a Pittsburgh district steel plant.



•OPEN HEARTH EQUIPMENT, DOOR HOISTS, CRANES AND JIB CRANES

•HUNT HYDRAULIC SYSTEMS AND AIR CONTROL VALVES

•MEDART STRAIGHTENERS AND TURNING MACHINES

•PALM OIL RECLAIMING SYSTEMS AND CENTRIFUGAL SEPARATORS

•CHEMICAL SYSTEMS AND CHEMICAL MACHINES

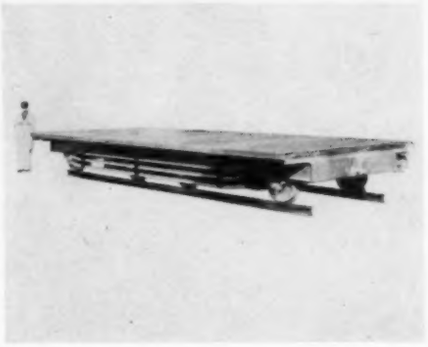
•COAL AND ASH HANDLING PLANTS

WRITE US FOR DETAILS!

TITZEL ENGINEERING & EQUIPMENT CO.

132 SEVENTH STREET, PITTSBURGH, PA.

Designers and Builders of Equipment for Steel Mills and other Industrial Plants



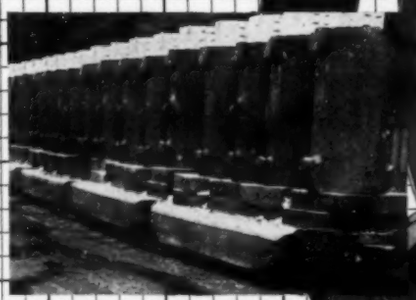
America, with construction by U. S. Army Corps of Engineers. The cars will serve a battery of furnaces in a completely automatic system developed for continuous heat treating of cast armor steel tank components for the U. S. Army. Rated as one of the most important projects in the defense production program, the Eddystone installation provides for extreme accuracy in mechanical-property tolerances through the application of automatic control to every step of the heat treating process.

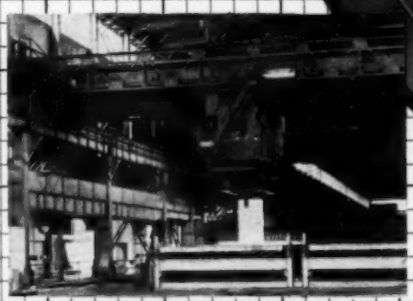
As a vital part of the automatic system, the electric driven furnace cars on which the heavy castings are mounted are delivered to the furnaces from the Easton transfer car. The sequence of the movement of the cars to the several furnaces and the timing of their passage through the zones of the furnaces, are automatically governed from centralized control stations.

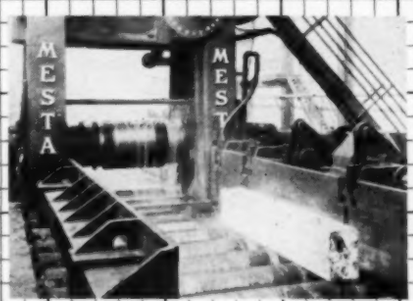
Each car is driven by two electric motors with chain drives to each axle. Power is supplied by a third rail. Measuring 26 ft 9 in. long by 11 ft 8 in. wide, each of the twenty-four furnace cars has a capacity of 75,000 lb.

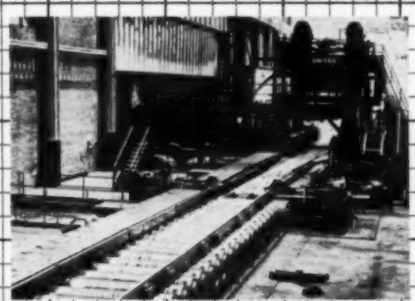
When finally assembled at Eddystone the cars will be equipped with an 8 in. refractory deck, and side and end sand seals. The cars in train will form the floor of the furnace. Sand sealing provides a comparatively cool trough for the motors and running gear, permitting the use of normal Class B insulation and preventing excessive distortion of the cars. While largely protected from the furnace heat by the refractory deck and sand sealing, the decks, beams and side angles of the cars are slotted at intervals to prevent expansion warpage.

Because the cars in train must form a practically continuous floor to the furnace they are built to an extremely fine tolerance (0 minus $\frac{1}{16}$ in.), and are coupled by means of a dogging









HYATT MADE IN USA

HYATTS
help make steel production records

LAST YEAR'S RECORD—an all time high—showed a production of 105,000,000 tons—8,000,000 tons more than the steel industry produced in 1950, and plans for 1952, if not interrupted, call for still greater tonnage.

To attain and maintain such a high production level, operating equipment must necessarily be at peak performance at all times.

And to help keep the mills operating successfully at this continuous pace, Hyatt Roller Bearings are serving and saving in tables . . . cars . . . cranes . . . mill motors . . . and other auxiliary equipment.

Thus, proved by performance, easing shock loads, extending equipment life, and reducing operating costs, Hyatts are the preferred steel mill bearings for new equipment or changeovers. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

HYATT ROLLER BEARINGS

arrangement which holds them snugly together. Limit switches at each end of the furnace will be adjusted to allow for normal expansion of the cars.

TWO-WHEELED TRAILER

▲ The "trail-skid," a two-wheeled trailer primarily designed for handling long lengths of materials in confined spaces, is a recent development of Phillips Mine & Mill Supply Co. Pulled by either fork or platform lift truck, this new unit also is adaptable

for transporting multiple palletized loads and for general plant hauling.

In operation, a lift truck engages the coupling mechanism mounted on an articulated turntable, lifts the skid legs free of the ground and moves the unit on its rear wheels. Cranes or lift trucks may be used to load and unload the trailer, which can be used either with or without stakes. The unit is available in five models, ranging in length from 7 to 16 ft. All models have a capacity of 10,000 lb, and feature solid rubber-tired wheels with Timken roller bearings.

The unit is particularly outstanding for its ability to maneuver long lengths of material in areas with minimum width intersecting aisles. For example, a load 24 ft long, when mounted on the trailer, can be made to make a 90 degrees turn in intersecting aisles as narrow as 14 ft, 4 in.

Here's an installation of a 4-High High Speed Rolling Mill for Strip and Foil built by Loewy Rolling Mill Division, Hydropress, Inc., properly equipped with STEARNS Magnetic Disc Brakes.

Quickly stopping the adjusting screws on this Loewy High Speed Rolling Mill is everyday work for STEARNS Magnetic Disc Brakes. Designed with a quick, steady pressure that brings a fast stop in the shortest time, STEARNS Magnetic Disc Brakes prevent overtravel of the adjusting screws and thus allow for careful, positive adjustment. Suitable for horizontal or vertical applications, STEARNS brakes are available in sizes up to torques of 575 pounds feet.

What is your overtravel problem? Give us the details; we'll forward recommendations without obligation. Remember, there's a STEARNS EXPERIENCE ENGINEERED unit for your screwdown requirements.

Foremost in the Magnetic Field

Stearns MAGNETIC INC.

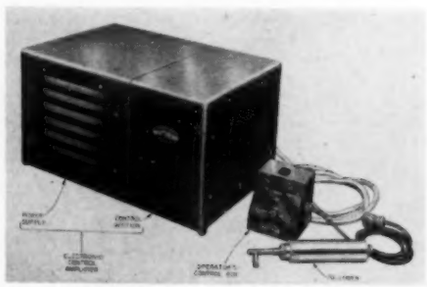
681 S. 28th St., Milwaukee 46, Wisc.

CONTOUR DUPLICATOR

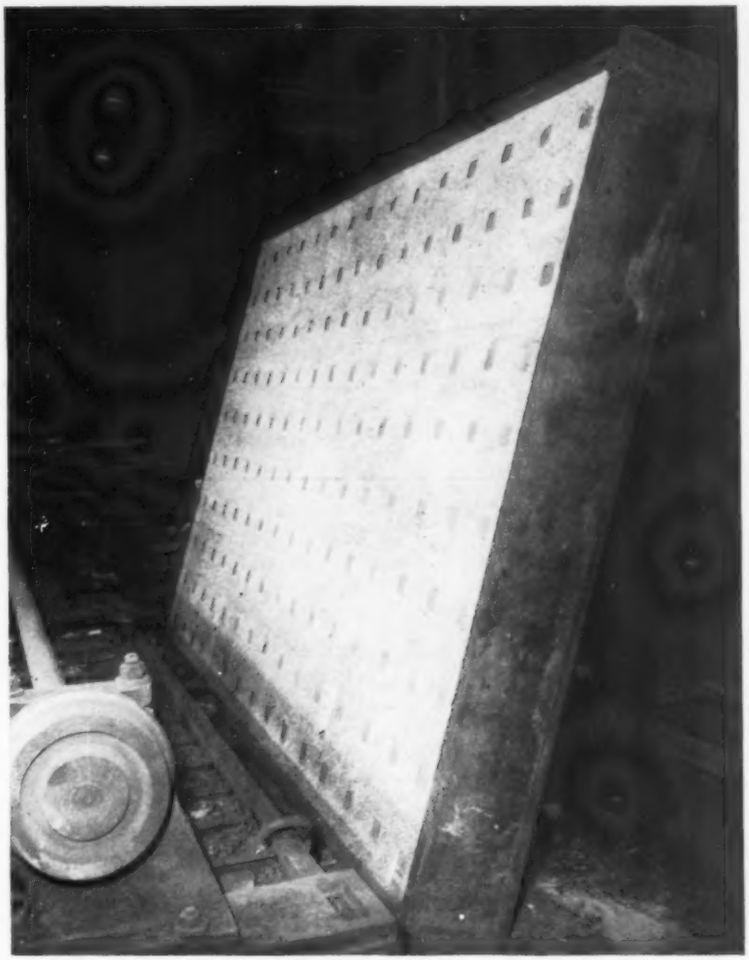
▲ The single motion duplicator, a new device with a "finger" more sensitive than those of human hands, is speeding up as much as seven times the precision machining of metal parts for vitally needed equipment. Through the use of this electronic robot that "feels" the contours of a master pattern, hundreds of parts, which are the exact duplicates of the original, are machined more accurately and in less time than by manual operation. It was developed by Raytheon Manufacturing Co. As installation problems of the duplicator vary according to the machine on which it is to be used, the Voss Engineering Co. acts as distributor for the equipment and handles all application engineering.

In the field, the duplicator is used in turning shafts, bearings, pulley sheaves, mill rolls, commutator rings, and similar parts of irregular contour. It has been used in die sinking operations and in producing cams of complicated design on milling machines. In many of these applications, the average time for completing a single part has been reduced as much as 80 per cent and spoilage by at least 20 per cent. The duplicator also aids in saving critical materials which are in demand in the emergency effort.

The duplicator consists of a follower, an electronic control unit, and an output drive motor. The follower is a variable reluctance transducer



RAMTITE
SOAKING PIT COVER—
One of Many Still in Service after 3 years of operation



This Ramtite cover, a test installation, the first of eight in one plant, was put into use in a regenerative type soaking pit heating 33,000 lbs. basic open hearth steel ingots for a slab mill. The photograph was taken before firing and after five months of air drying. The combination of Ramtite cover lining and Ramtite designed slab cover frames has enabled many plants to effect considerable savings both in refractories and in the elimination of expensive hangers and sand seals.

RAMTITE STANDS FOR PROGRESS IN PLASTIC AND CASTABLE REFRACTORIES

Ramtite specialization in designing and engineering of refractory construction has caused an ever widening recognition of Ramtite quality and reliability.

Because of Ramtite's many years in the refractory specialty business it has considerable experience which you can draw on profitably. When you are planning a job that has to do with refractories, remember that Ramtite ingenuity and engineering can help you. Unusual requirements can be met with new and fresh ideas that can mean considerable savings in time and money.

Send for complete information on Ramtite products and services.

THE RAMTITE CO.
DIVISION OF THE S. OBERMAYER CO.

1813 S. ROCKWELL ST.
CHICAGO 8, ILLINOIS

RAMTITE

PLASTIC AND CASTABLE REFRACTORIES

whose electrical output varies in accordance with the contours of a template. This signal is amplified and detected in the electronic control unit, providing drive to the output motor. The motor, in turn, positions the follower and cutting tool. Thus, the contour of the template is reproduced automatically on the work.

ELECTRONIC CONTROLLER

▲ An electronic strip chart recording and indicating program controller has been introduced by the Minneapolis-Honeywell Regulator Co., Industrial division, to meet a continuing demand for more fully automatic industrial process control.

The new "ElectroniK" controller, provides a means for automatically conducting the complex time-and-temperature programs required in heat treating operations and other processes. This will minimize manual regulation and the always present human error factor.

The instrument is equipped with a motor driven set point index in addition to temperature measuring, controlling, recording and indicating components, and will automatically maintain pre-set rates of temperature rise, fall, and timed soaking or holding periods.

Now available for shipment, the strip chart program controller can be supplied as a single or multi-record electric contact or proportional controller, or as a single record pneumatic controller.

MOBILE CRANE TRUCKS

▲ A new line of mobile crane trucks, particularly adapted to handling heavy castings, machinery, bar stock, sheet metal packs and other irregular-shaped material in and out of flat, gondola or box cars, has been announced by Baker Industrial Truck division of the Baker-Raulang Co.

With their 19 ft telescoping booms, these units are a valuable tool for

locomotive stripping in the repair shop, erection jobs, dock, warehouse and general millwright work.

Combining travel, hoist, boom and slew motions in one sturdy compact unit, they also supplement overhead crane equipment by working in areas not served by such equipment. Capacities available are 6,000 to 10,000 lb.

WATER TREATMENT

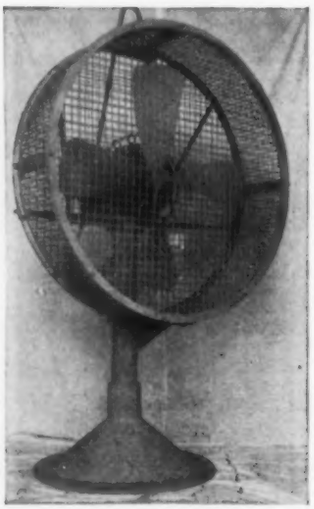
▲ A new water treatment process and equipment called "Hydrotron" eliminates scale in heat exchange equipment by changing water electrophysically, so that minerals contained in the water crystallize out in the form of a sludge or slurry and do not form a dense hard coating over heat exchange surfaces. The sludge formed can be removed by the usual methods of blowdown. This process is suitable for treatment of fresh water or salt water.

The process, introduced in the

IS HEAT SLOWING UP YOUR WORKMEN?

TRUFLO CRANE CAB FANS
For cooling interiors of crane cabs and other confined areas. Adjustable both horizontally and vertically. Four blade type, 12 and 18 in. sizes.

Keep them COOL with TRUFLO FANS



TRUFLO PORTABLE COOLING FANS
Easily portable. Help keep efficiency high where work is hottest. 12 to 36 inch diameters.

Production suffers when workmen are overheated. Steps begin to drag, efficiency falls.

Now, when speedy production is vital, Truflo Fans can help keep your workmen on their toes. All Truflo Fans are designed and built correctly to put fresh cool air *in large volumes* exactly where it is needed. Perfectly-balanced shafts and blades give more air per h.p. . . . strong steel frames stand up longer under hard use . . . rugged wire guards protect men against injuries.

All of the following types can help beat the heat, keep production moving in your plant. Write for illustrated literature.

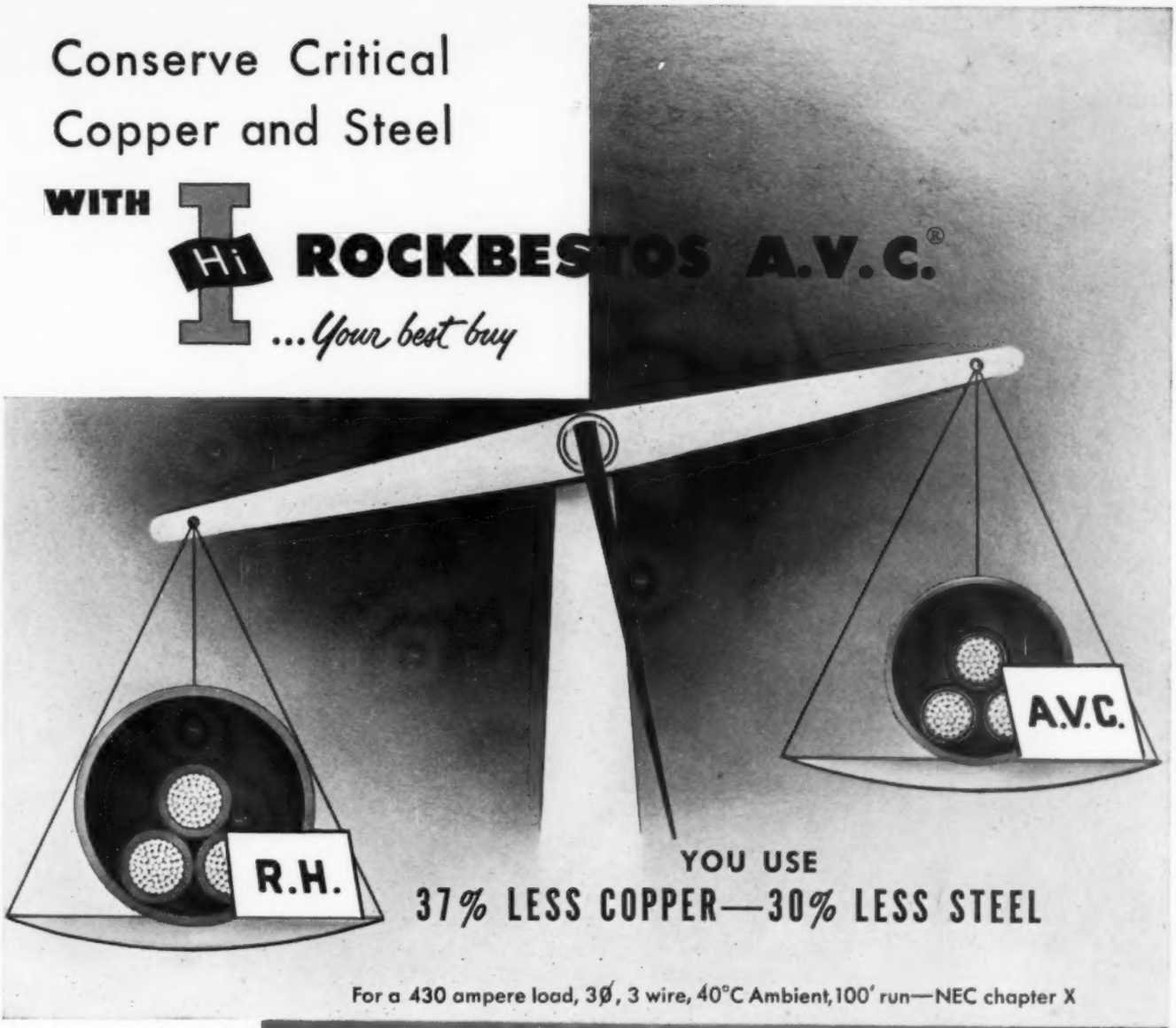
PORTABLE COOLING FANS
CRANE CAB FANS • WALL FANS
EXHAUST FANS • BLOWERS
ROOF VENTILATING FANS
PENT HOUSE FANS

TRUFLO FAN COMPANY
245 MAIN ST., HARMONY, PA.

Conserve Critical Copper and Steel

WITH Hi **ROCKBESTOS A.V.C.®**

...Your best buy



YOU USE

37% LESS COPPER—30% LESS STEEL

For a 430 ampere load, 3Ø, 3 wire, 40°C Ambient, 100' run—NEC chapter X

		TYPE RH	TYPE A.V.C.	
CONDUIT	SIZE	4 inch	3 inch	A saving of 327 lbs. of steel
	WEIGHT	1089 lbs./100'	762 lbs./100'	
CABLE	SIZE	800 MCM	500 MCM	A saving of 277.8 lbs. of copper
	WEIGHT	741 lbs./100'	463.2 lbs./100'	

Write for booklet "Rx for a Building with Hardening of the Arteries."

Hi $I=\frac{E}{R}$

...Your best buy

ROCKBESTOS PRODUCTS CORPORATION

NEW HAVEN 4, CONNECTICUT

Chicago, Detroit, Pittsburgh, St. Louis, Cleveland, New York, New Orleans, Los Angeles, Oakland, Calif.

United States in 1948, has proven to be entirely successful in this country and is being used to treat extremely hard water as well as softer waters in many different types of equipment and under varying operating conditions.

The "Hydrotron" process, developed by Heller Laboratories, eliminates the need for a water softener or chemicals for the control of hard water scale in boilers, evaporators, condensers, bottle washers, hot water supply systems, air conditioning equipment, or in any equipment where mineral scale forms due to hard water. This new process is particularly well-adapted to control scale in once-through systems, such as hot water supply systems or cooling water systems where chemicals or water softeners are not practical or the cost of such treatment is prohibitive. The process is also well-adapted for treatment of water for boilers making steam to be used in food processing, as there is no danger of contamination of food from chemicals.

The equipment consists of a bronze pipe unit, installed in the water supply line, and an electrical control unit, which is mounted in a convenient position nearby. The entire apparatus is of simple, sturdy construction, requiring a minimum of care or attention in operation. There are no anodes to replace. The unit has unlimited life expectancy. Operation cost is only a few cents per month. The initial cost of the equipment is moderate, being less than that of a softener of comparable capacity. Simple instructions for installation and operation are supplied and a typical Hydrotron installation can be made in a few hours.

"Hydrotron" is not a water softener. The water is not changed chemically. There is, however, an electro-physical change that takes place after treatment, in which the process of nucleation is affected.

Resolite is shatterproof. It can be worked, sawed, drilled with ordinary tools, and its installation ease is economical of manhours.

TRANSLUCENT STRUCTURAL PANELS

Resolite makes large skylight and wallight areas economical for corrugated industrial buildings because no special framing is required, either for support or weatherproofing — it nests with any standard corrugated sheet. Resolite permits substantial savings in plant lighting by its efficient diffusion of daylight through the building interior.

Structurally rugged, chemically immune to weather extremes, and most industrial fumes, Resolite gives long life without protective treatment. Resolite is molded in standard sheet sizes and corrugations, made of polyester resins, reinforced with fiberglas mat — a quality product with controlled uniformity of thickness for strength and durability.

SPECIAL ARCHITECTURAL USES, TOO!

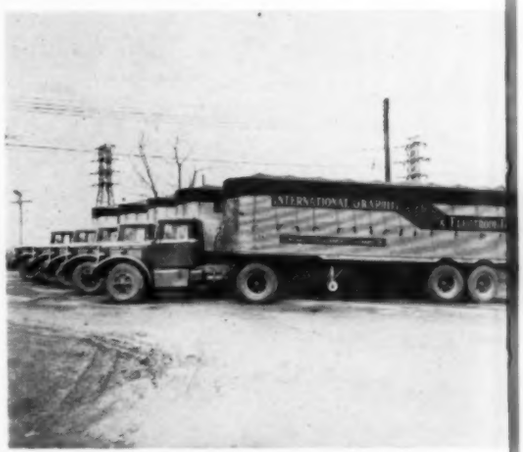
Interior and exterior decorative beauty is easy to obtain with Resolite's wide variety of colors and corrugated patterns. Store fronts, marquees, bar facings and patio covering are simplified in structure and assembly. While transmitting light freely, Resolite is impervious to vision, making it ideal partitioning for offices, shower stalls and toilet compartments.

Write for free literature

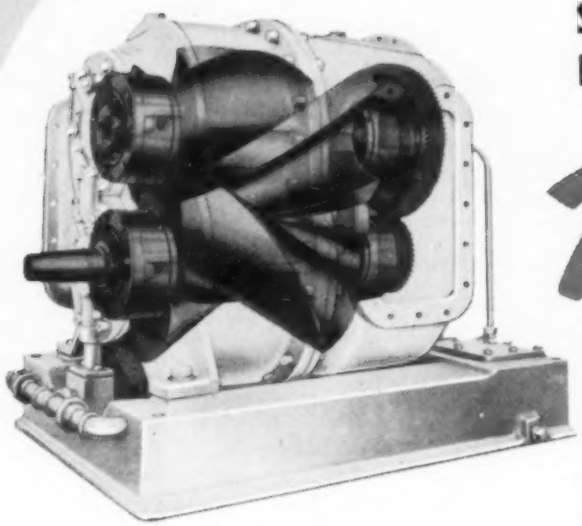
RESOLITE CORPORATION

ZELIENOPLE, PA.

NEW TRUCK FLEET



To insure more reliable and less expensive shipping of baked carbon electrodes and calcined coke between the Saint Marys, Pa., and Niagara Falls, N. Y., plants of International Graphite and Electrode Corp., six new heavy-duty trailers and five tractor-trucks have been purchased and put into service. Using an alternating system, one trailer is kept at Saint Marys where it is loaded with electrodes made by IGE's parent company, Speer Carbon Co. When a tractor arrives from the Falls with an empty trailer, it is switched to the loaded one and is dispatched back to the Falls. Five shipments are made each day, a total of 350 miles per round trip. At present, the trailers are carrying electrodes to the Niagara Falls plant to be graphitized and are returning empty, but when the new calcining facilities at Niagara are completed, they will haul calcined coke on the return trip to Saint Marys.



STANDARDAIRE BLOWER DESIGN

Plus

SKF BEARING ENGINEERING

Every so often, a manufacturer has a chance to *prove* his wisdom in the selection of the product components he specifies.

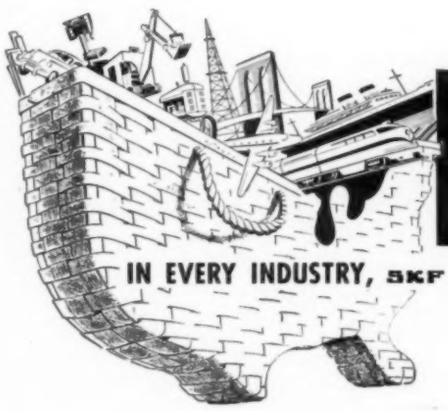
For example, Read Standard Corporation was able to obtain performance data on one of their "Standardaire" Blowers which had operated 24 hours a day, for 15 months, at 2200 rpm.

In other figures, that's about one and a half billion revolutions—representing many years' service for typical blower installations.

Even after the hard, difficult service, this blower and bearings were found to be in excellent condition when dismantled and inspected in the presence of Read Standard customer's representative.

Performance like this is proof of sound *design*—proof, too, that the designers selected the best available materials and component parts . . . among these were SKF Bearings.

Here we quote from the "Standardaire" Blower performance report: "Anti-friction bearings in good condition." They were SKF Cylindrical, and Spherical Roller Bearings, designed into the gate rotor shaft and main rotor shaft as shown in the illustration.



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Remember—if you want design assistance and engineering help when you're laying-in bearings, you can get it from SKF field or home office men who know the best ways to do the job in every industry. **SKF INDUSTRIES, INC.**, PHILADELPHIA 32, PA.—*manufacturers of* SKF *and* HESS-BRIGHT *bearings.*

7323

METAL CLEANER

▲ Pennsalt EC-51, a new rust-inhibiting organic-type metal cleaner, has been announced by the Pennsylvania Salt Manufacturing Co.

Newest addition to the Pennsalt line of emulsion cleaners, used by the metal industry for many years, the new product combines powerful detergent action with a high degree of rust protection.

Steel parts cleaned in the new metal cleaner obtain protection from rusting for up to six weeks under normal plant conditions. Even under unfavorable conditions, protection for two to three days can be expected.

The new cleaner is equally efficient in removing soil from all of the nonferrous metals without staining or etching.

Developed at Pennsalt's research laboratories, the product has been field tested in a number of metal processing plants. In addition to providing cleaning and rust inhibition in a single operation, the cleaner has also proven highly successful in cleaning prior to painting. Pieces cleaned can be painted directly after rinsing and drying without further treatment.

The cleaner is used in concentrated or diluted form and can be applied by both spray and immersion methods. In spray cleaning, a dilution of from 50:1 to 100:1 will apply to most cleaning and rust protection applications encountered in industry.

The new cleaner is non-caustic, non-explosive, harmless to the hands and does not create toxic working conditions. It is packed in 50-gal drums.

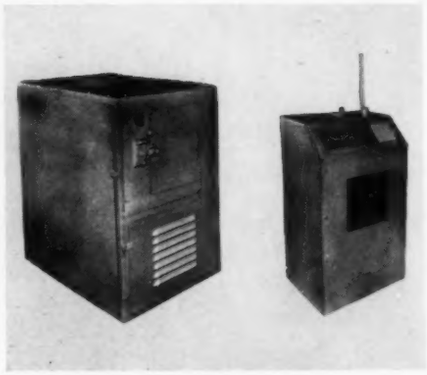
CRANE CAB COOLER

▲ To complete its line of crane cab air conditioning and ventilating equipment, Dravo Corp. has developed a new split-type crane cab cooler of the three-horsepower size.

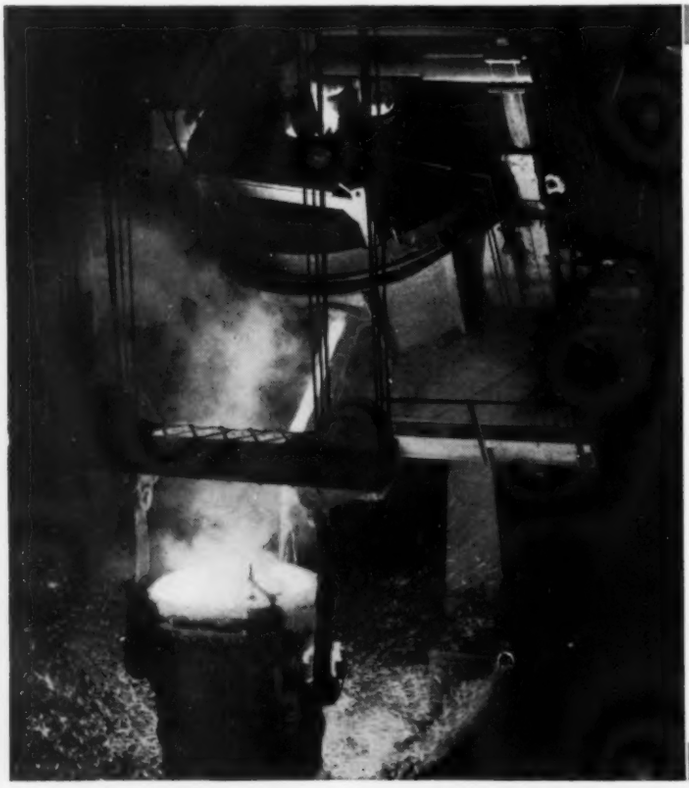
This model, the C-3SP, now provides a comprehensive group of crane cab conditioning and ventilating equipment which includes horizontal, vertical, self-contained and split-type units of three, five, or seven and one-half horsepower sizes.

The new model is designed to maintain a temperature of 80 to 85 F within a crane cab when the surrounding ambient temperatures reach 130 F. The unit, which supplies continuous ventilation, is equipped with electric strip heaters for winter heating, dust and dirt filters and activated carbon canisters for fume and odor removal.

Operation and control for summer and winter temperatures is fully auto-



Split-type crane cab cooler of the three-horsepower size was developed to round out a line of crane cab air conditioning and ventilating equipment. On the right is the small compact evaporator section for installation inside the cab. Left is the condenser section which may be located in any convenient place on the crane.



Heroult

ELECTRIC MELTING FURNACE

. . . as ever, the dependable furnace for the production of high-grade stainless, alloy and rimming steels.

Removable roof of new design now available for the larger furnaces.

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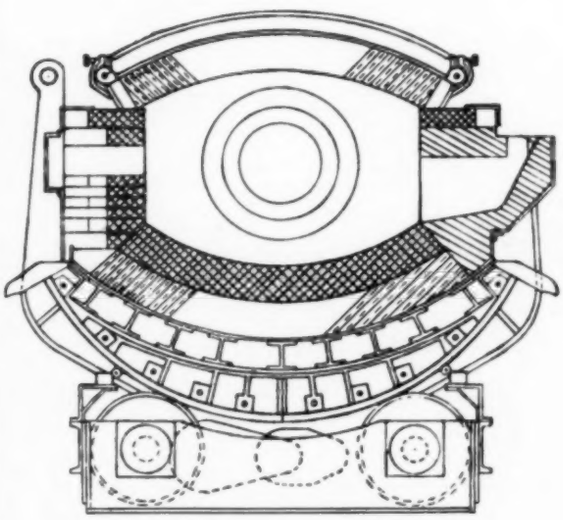
Here's how to HOLD THAT LINING in your holding furnace

Operators of Whiting* Cradle and similar types of holding furnaces use Taylor Sillimanite (TASIL) brick and cement to prolong the life of refractory linings. Recommended practice is to "*balance*" the super-duty fire brick lining with 9" of TASIL brick, laid in TASIL No. 301 Cement, for both side walls and bottom, in the areas subject to the damaging wash of molten iron and slag. (See refractory construction shown in engineering drawings below.)

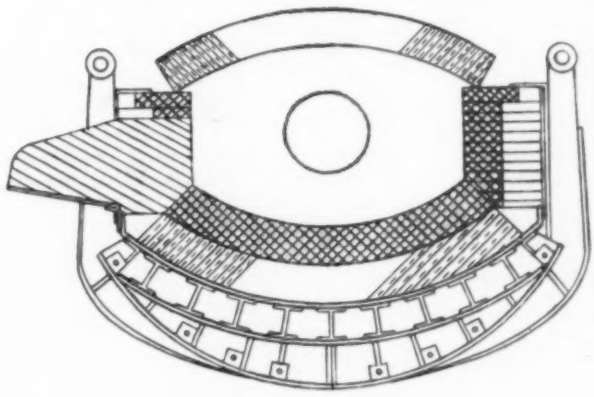
A TASIL "balanced" lining at one plant is averaging 6-8 weeks on side walls and 9-12 months on bottoms, with patching. TASIL was tried after a super-duty fire brick lining failed in three days because of joint attack and severe erosion at the metal line. This furnace is fired with pulverized coal and runs 700 tons per week of grey iron, tapped from cupola at 2750° to 2800° F.

Wherever you use fireclay-base, high alumina, kaolin or similar refractories, TASIL will give more effective service. Let a Taylor field engineer discuss with you the savings Taylor Sillimanite can make in your plant.

Tasil "Balanced" Lining In Whiting Cradle Furnace



Section through Pour-in Spout



Section through Pour-out Spout

TASIL sidewalls and bottom 9" thick. TASIL top course in sidewall 13½" thick.

= Taylor Sillimanite

* Built by Whiting Corporation, Harvey, Ill.

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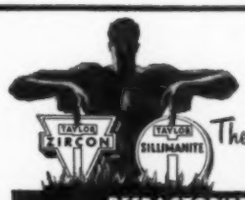

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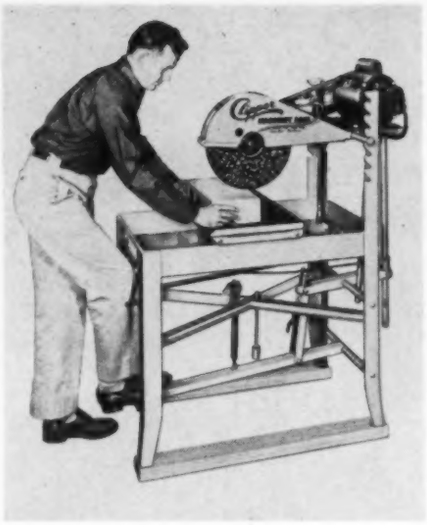
matic. The small, compact evaporator section can be installed within the cab, while the condenser section may be located in any convenient place on the crane. The two sections are connected by refrigerant piping.

MASONRY SAW

▲ A new convertible masonry saw was the subject of a recent spot survey conducted by the Clipper Manufacturing Co. in both the building and industrial fields.

Owners of the masonry saws expressed enthusiasm at being able to convert their present equipment into a concrete and track saw. Others who were surveyed indicated that in many cases the extra uses offered so much additional justification that they were planning to purchase.

The convertible "Model HD" masonry saw, which is actually both a wet (dustless) and dry saw, can be converted to both a concrete and track saw. At any time the cutting head of the masonry saw can be placed on the convertible (4 wheeled) cart. The equipment is then ready for sawing concrete or asphalt patches or



trenches in building floors, drives and walks.

Through such a conversion it is possible to switch from sawing glazed tile, concrete block, and fire brick to sewer, water or gas lines and floor patches in a matter of minutes. Fractures from jack hammer operations are now confined within the sawed removal lines plus the elimination of spalling.

By placing this convertible cart on tracks, a fourth use is accomplished. Stone slabs, "Transite" sheets, precast stone, large refractories, plywood and masonite can be placed under the elevated tracks and sawed with this convertible track saw.

MEEHANITE CASTINGS

▲ In keeping with a long established policy of achieving maximum product quality, the De Laval Steam Turbine Co., has completed installation of the Meehanite process controls in their foundry.

The foundry produces about 25 tons of castings daily for such De Laval products as centrifugal and rotary pumps, steam turbines, centrifugal blowers and worm gear speed reducers.

Iron castings are frequently the truly vital components of units of this type. As such they must provide superior and definite engineering and design characteristics. The adoption of the Meehanite processes in the foundry results in the ability to produce a series of engineering irons with properties predetermined and adjusted to meet exact specifications.

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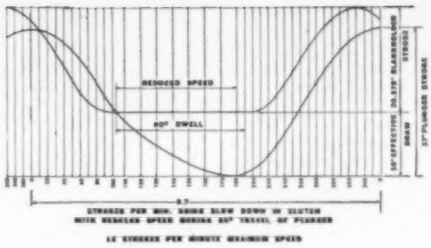
For example, tensile strength upwards to 50,000 psi can be provided in "as cast" units while with heat treatment strengths up to 75–80,000 psi are achieved. Similarly Brinell hardness ranges, toughness, and ductility may be controlled according to need.

Fundamentally, the Meehanite processes give the foundry a series of scientific methods which permit the regulation of the basic structure of the irons and the properties of the materials are of course, a function of these structures.

DRAWING PRESS

▲A new series of four-point, double-action, toggle-drawing presses featuring quick advance and return speeds and extreme accessibility for maintenance purposes, has been developed by E. W. Bliss Co. The new presses are specially designed to meet the needs of the automotive and allied industries by making possible higher production rates for large-area, drawn stampings.

Greater production rates have been made possible through use of the



Eddy current clutch which provides for quick approach to the work, slow-down to give proper drawing speeds, and quick return speed to the top of stroke. Even with comparatively slow drawing speeds, a rapid press cycle is possible. The slow-down is accomplished by controlled slippage of the Eddy current drive clutch through limit switches which can be adjusted to vary the speed of any portion of the draw cycle.

There are three substantial crossmembers in the crown which contains four totally enclosed gears with integral eccentrics for operating the plunger slide. Crown sections beneath the gears form a rigid tie member for the front, center and back transvertical sections. All gearing and toggle bearings inside the crown are lubricated by a cascade oil system.

Each main rockershaft is in one piece and is easily removed from the top of the crown by unshrinking the rockershaft bearing cap tie-rods with Calrod units. The intermediate rockershafts are also removable from the top of the crown.

Provision has been made for pneumatic die cushions in the bed, or the bed can be fitted with a synchronized third motion if required.

The presses are built in a complete line of sizes and widths.

STRIP HEATERS

▲ The Atlas Car and Mfg. Co. now installs a lacework of strip heaters under the floor of its 60-ton, bottom dump ore-transfer cars as a means of keeping ore from freezing and sticking to the interior of the cars during winter months.

The cars, manufactured by the Cleveland, Ohio, firm, are used for filling the bins on blast furnace high lines. Because these bin-filling cars are generally loaded by buckets, the operation takes enough time to allow the ore to freeze in the inside of the

(*Please turn to page 206*)

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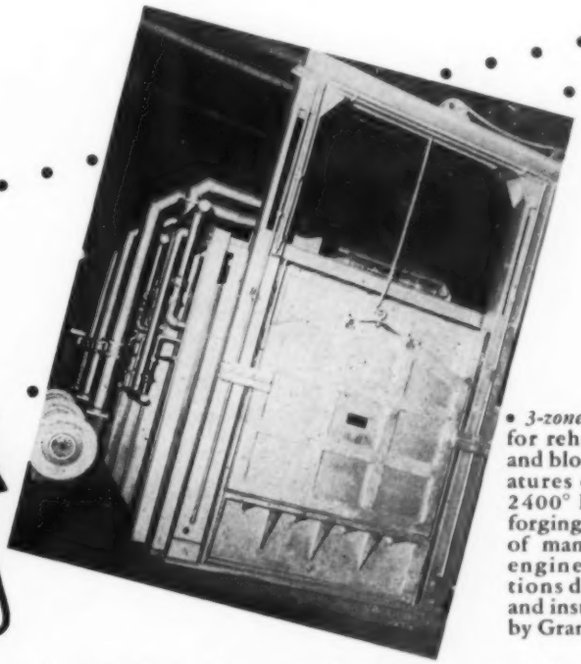

• *3-zone reheat furnace* for reheating billits and blooms to temperatures of 2250° F to 2400° F previous to forging or rolling. One of many individually engineered installations designed, built and installed complete by Grant Watson.

Designers of individually engineered heating and heat treating furnaces, both gas and oil fired, for reheating slabs, billets, rods, bars and blooms; forging; soaking pits; annealing and normalizing; stress relief; and other industrial heating applications.

Grant Watson "Custom Engineered" furnaces deliver maximum heating efficiency, uniform product quality, positive temperature control plus the versatility and flexibility that pays off in increased tonnage and economical operation. Regular COST-FREE SERVICE after installation reduces maintenance costs, assures trouble-free performance day-in and day-out.

Write, wire or call for instant service on custom engineered furnaces to meet your requirements and specifications

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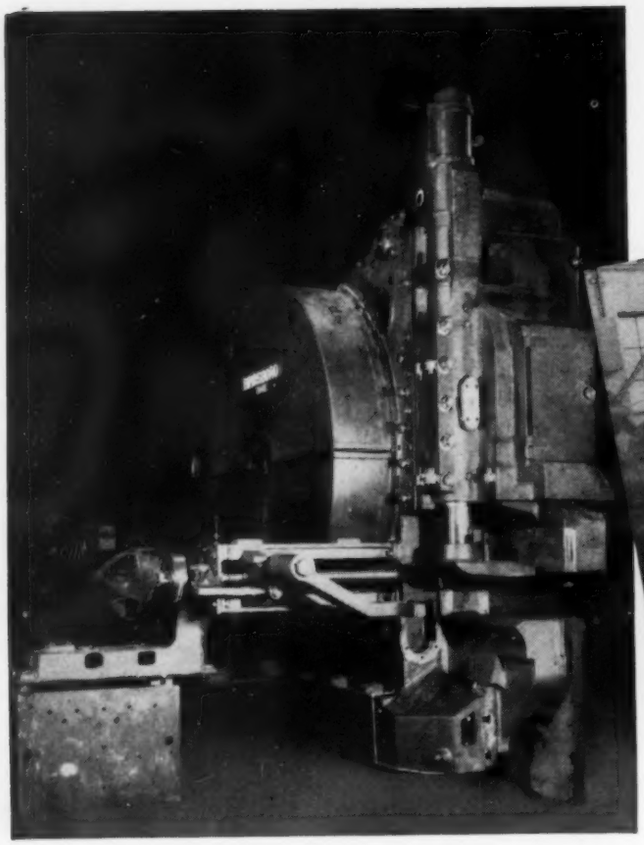
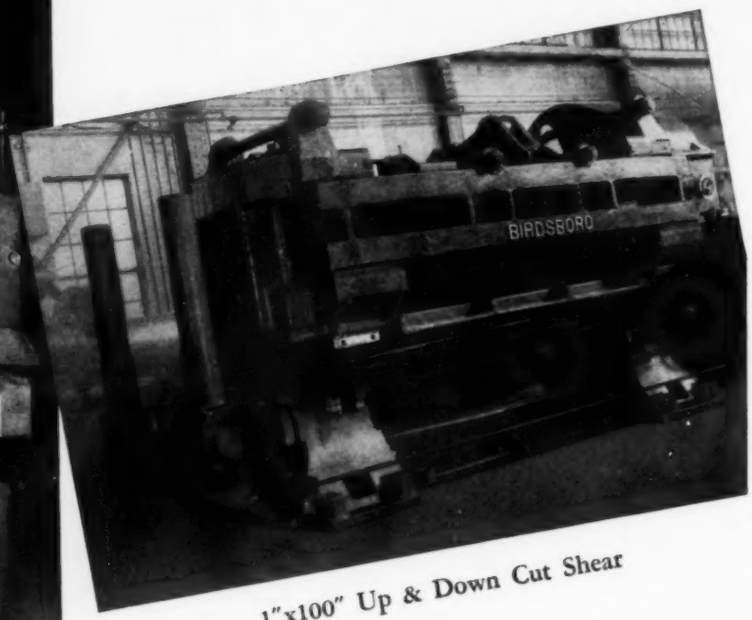
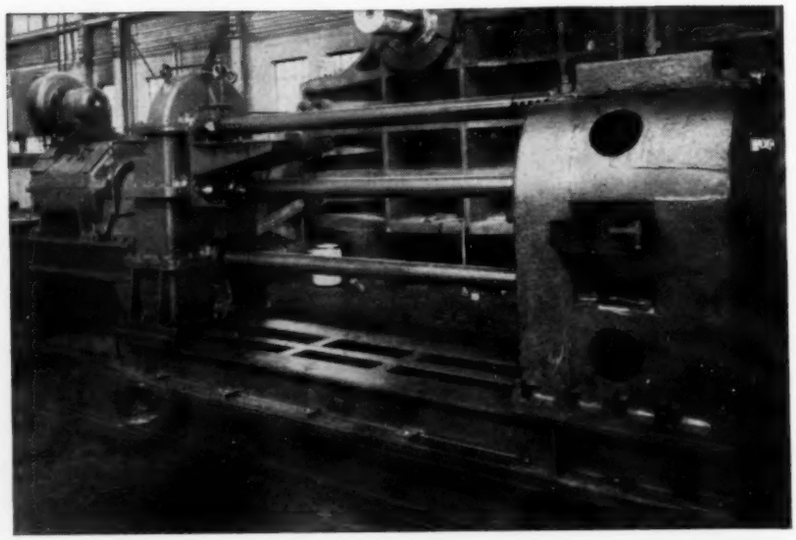


770 Ton Up & Down Cut Shear and Gauge



1"x100" Up & Down Cut Shear

Merchant Mill Flying Shear



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(1) Strip-Chart Potentiometers

Just published is a bulletin describing the "Dynamaster" electronic potentiometers and bridge instruments for industrial use. The 36-page bulletin gives information concerning a number of new electronic instruments for recording and indicating such variables as temperature, pH, speed, voltage, power, current, smoke density, thickness, strain, and a wide variety of other variables which can be measured in terms of d-c current, d-c voltage, resistance, or capacitance. In addition to single and multiple point recording models, pneumatic and electric-operated automatic control models are also described. The bulletin is liberally illustrated with photos of the basic electronic components of instruments and of the various models offered as well as reproductions of charts and wiring diagrams showing principle of operation. New applications of these instruments are also included. (P1245). Bristol Co.

(2) Catalog on Presses

Just issued is a new 28-page general catalog describing and illustrating a complete range of mechanical and hydraulic presses and special machinery for almost every type of metalworking operation. Condensed specifications and dimensions are included. (35-C). E. W. Bliss Co.

(3) Pump Castings

A completely new 20-page bulletin entitled "Meehanite Pump Castings" is available to you. In addition to numerous photographs of pump castings and the various types of pumps that utilize Meehanite castings, there are several tables and charts which graphically illustrate property evaluations made from recent tests covering wear, resistance to acid corrosion, impact, etc. Copy will be sent free upon request. (36). Meehanite Metal Corp.

(4) Hoist Catalog

To acquaint industry with their complete line of equipment, American Hoist & Derrick Co. has published a new general catalog which is now available. It covers all equipment from their giant revolver cranes, through their extensive line of locomotive cranes, hoists, material elevators, car pullers right down to the famous "Crosby" wire rope clips. (GC-2). American Hoist & Derrick Co.

(5) Fundamentals of Instrumentation

The "Fundamentals of Instrumentation for the Industries" is the title of a booklet which consists of 126 pages. As the title indicates, it covers the fundamentals of measurement, control and transmission of variables encountered in industry. Typical applications are also discussed. (80-2). Minneapolis-Honeywell Regulator Co., Industrial Division.

(6) Signal Batteries

The publication of a new catalog section describing and illustrating "Eveready Air Cell" signal batteries is announced. The construction and application of "Eveready" air-depolarized, constant voltage primary batteries are described and operating characteristics tabulated. The "Air Cell" Type AC-500 signal battery, which uses standard glass jars, has a capacity of 500 ampere-hours and because of its higher voltage will replace copper-oxide cells in the ratio of approximately one for two, in series batteries. (R-9505). National Carbon Co.

(7) Valves

A new 8-page bulletin is available describing the features of cushioned automatic water and steam valves. Featured in this catalog are float valves, altitude valves, check valves, solenoid-operated valves, reducing valves, relief valves and non-return valves — valves used by industries everywhere. (G-3). Golden Anderson Valve Specialty Co.

(8) Air-Operated Combustion Control

A detailed account of tried-and-proved automatic combustion control techniques for oil and gas fired boilers is now available in a 24-page bulletin. Comprehensive illustrations and descriptions include lucid diagrammatics showing nine typical firing methods and 16 major control equipment components. There are also individual facts and figures on 300 installations throughout the U.S.A., ranging from 6000 to one million lb/hr capacity. (1023). Bailey Meter Co.

(9) Mechanical Drive Turbines

Pyle-National Co. has just released six new bulletins describing the company's line of high-efficiency impulse type steam, gas or air turbines for mechanical drive, which has recently been expanded for general industrial use. One of the bulletins is devoted to each of the five types of turbines available, ranging from ¼ to 120 hp, giving performance charts, construction details, dimensions and weights and selection data. The sixth bulletin provides general turbine information. (4110-A through 4110-F).

(10) Galvanometers and Dynamometers

A complete line of standard galvanometers, dynamometers, d-c indicating amplifiers, and accessories for use in null-balance or calibrated deflection measurements is presented in the newly-revised, 20-page catalog section, "Galvanometers and Dynamometers," which has just been published. In addition to the well-known d-c and a-c galvanometers of the pointer or reflecting type, this publication now describes and illustrates low-level d-c indicating amplifiers which can be used as null detectors, direct-reading instruments, and recorder pre-amplifiers. Other new information tells about the outstanding design features of these and other detectors. Galvanometer reading devices of new design are also pictured and listed for the first time. The catalog section includes a galvanometer selector

guide, replete with diagrams that graphically define various galvanometer characteristics. Equipment listings are complete and specifications are presented in tables to make comparison easy. (ED). Leeds & Northrup Co.

(11) Pipe Tools

A new 1952 catalog and data book that should be of great interest to users of pipe tools is available. The new catalog gives readers pertinent information on three pipe and bolt machines. Four pages in the back of the catalog are devoted to an "Operating Guide" designed to assure users best results from pipe and bolt machines and hand tools. Fully illustrated with easy-to-grasp pen and ink drawings and technical copy that quickly tells how to locate and correct pipe tool troubles, the guide clarifies thirty-one different operations. Beaver Pipe Tools, Inc.

(12) Reversing Control For Planers

New literature is available describing EC&M control for planers. The impedance-electronic limit switches have not only been applied on planers, but have also been used on other reversing industrial drives where frequent reversal has caused high maintenance of the limit switches, particularly, the engagement type of limit switch. Positive stopping on power failure is an important consideration today where round-the-clock operations prevail. Should the planer be the only direct current drive operating, with other operations driven by alternating-current motors, a serious delay might result on late shifts if the d-c power for the planer failed when a quick stop was needed. And with the EC&M method described in this booklet, quicker stopping is obtained on power failure than when the motor is operating and stopped by normal shop line voltage. (927). Electric Controller & Manufacturing Co.

(13) Speed Reducers

A new 48-page bulletin is available that describes a complete line of double worm and helical-worm gear speed reducers. Complete data is included on horsepower, output torque and center distances for reductions up to 6400:1. Detailed information on how to select double reduction gearing, examples of selection, horsepower rating tables, dimension sheets and complete physical data make this an exceptionally useful bulletin. (G-WWH). De Laval Steam Turbine Co.

(14) Centralized Instrumentation

A bulletin is available consisting of 32 pages, describing conventional and graphic type panelboards, as well as the measuring and control instruments utilized. (85-20). Minneapolis-Honeywell Regulator Co., Industrial Division.

(15) Industrial Heater Maintenance

The "Care And Maintenance Of Steam And Hot Water Unit Heaters" is a new, four-page publication and a copy belongs in every user's file. Well illustrated and concisely worded, it covers the proper procedure in getting the most out of these efficient heating units. Regular care is not expensive, yields large dividends in trouble-free operation and is the mark of a well operated system. (12). Industrial Unit Heater Association.

(16) Pyrometric Switches

A catalog is available that illustrates and describes rotary, key and plug type pyrometric switches. Applications and pertinent circuits are also given. Dimensions, mounting details and switch circuits are included. (5800). Minneapolis-Honeywell Regulator Co., Industrial Division.

(17) Hot Topping Compound

Just released is a new folder describing "Mexatop," a new hot topping compound for ingot heads and casting risers. According to the folder "Mexatop," due to its excellent insulating properties, allows more efficient feeding by the hot top or riser thereby giving maximum metal yield. The new graphite follows closely the contour of the shrinking metal and provides maximum protection throughout the entire cooling cycle. This action promotes the formation of a cup-shaped shrink cavity indicative of efficient metal feeding. U. S. Graphite Co.

(18) Fractional Hp Motors

A new line of fractional horsepower motors embodying an entirely new concept of motor design and manufacture has been announced in a bulletin available to you. Designated as "Form G," the new motors are the result of nearly a decade of developmental engineering and research, and incorporate many radically different and advanced design features.

According to engineers who worked on the project, the Form G motor weighs as much as 51 per cent less per horsepower than the models it replaces and is considerably smaller in size. At the same time, its versatility of application has been broadened and its appearance modernized. The motors are available in open dripproof and totally enclosed fan-cooled models in Types K (polyphase), KC (capacitor start), KH (split phase), and KCP (permanent split capacitor). These have hundreds of applications — on pumps, fans, blowers, compressors, office and home appliances, motorized tools of all sorts, etc. The design principles ultimately will be adapted to motors for more specialized uses as the Form G line expands, the engineers said. (GEA5567). General Electric Co.

(19) Long-Wearing Machinery Parts

A wide variety of cast and wrought alloy parts now being used in many industries to solve abrasion, corrosion, and high-temperature problems is described in a new 24-page booklet, "Long-Wearing Machinery Parts." More than 60 blueprints, tables, and photographs show some of the sizes and shapes in which alloy parts are being used. The parts described are made of the various Haynes cobalt-, iron-, and nickel-base alloys which have had wide use as metal-cutting tools and many types of valves and furnace parts. (F-7158). Haynes Stellite Co.

(20) Beta Gage

A booklet is available describing the "AccuRay" beta gage which was first developed for the rubber and paper industry. The gage is now being made available for metal industries. According to the booklet, the new gage measures square yard weight directly with better than one per cent accuracy. Industrial Nucleonics Corp.

(21) Engineering and Construction Services

A reprint of a technical article is available telling how a special extraction turbine equipped with a condenser and special governors serves as a reducer controlling extraction steam to the low pressure units, and can also operate straight condensing. This installation was made at the Bayboro plant of the

Florida Power Corp., St. Petersburg, Fla. The article was written by the production engineer of this company and was published in "Southern Power and Industry." Included with the reprint is a map showing the extent of the engineering and construction services of this company. Kuljian Corp.

(22) Worm Gear Catalog

Just off the press is the Cleveland Worm & Gear Co.'s new general catalog. Its 180 pages illustrate and describe each model in the complete line of Cleveland worm gear speed reducers as well as worm and gear sets for built-in power transmission applications. You'll find this catalog genuinely helpful in selecting worm gearing and worm gear speed reducers. It contains engineering and application data on each unit, including dimensions, weights and rating tables—all the information you need to determine the correct Cleveland drive for your equipment. Through its entire 40 years of operation, Cleveland has devoted its engineering and manufacturing facilities exclusively to the design and production of worm gearing and worm gear speed reducers. (400). Cleveland Worm & Gear Co.

(23) Flow Meter Handbook

A new 40 page handbook has just been published to aid in the selection and sizing of variable-area meters. This illustrated handbook contains, in condensed form, the results of fifteen year's engineering research. A complete description of variable-area meters, tubes and floats and their comparison with variable-head meters, as well as calibration prediction data has been included. Fischer & Porter Co.

(24) Storage Racks

A bulletin just released, presents steel storage racks for drums, barrels, crates, bins, skids and pallets. All these applications are illustrated with installation views. The need in many establishments for more floor space clashes with the discouraging cost of new buildings. This bulletin demonstrates how storage rack systems solve this dilemma in an economical and satisfactory manner. The racks pictured multiply the storage capacity of floor space several times by by storing materials and goods right up to the ceiling; gaining large areas of valuable floor space for profitable production operations. Rack storage prevents breakage and damage. All stock is visible and always accessible. "Inventory time" is substantially shortened, and order picking is speeded up. (5221). Barrett-Cravens Co.

(25) Hard Facing Chart

A procedure chart for hard facing of mill guides is available to you. The chart shows how a large eastern seamless steel pipe manufacturer had 30 times more tonnage by using Amsco hard facing rods on mill guides. (451:7). American Manganese Steel Division, American Brake Shoe Co.

(26) Powder Washing

Removing excess or defective material from castings is described in a new, eight page, illustrated booklet, "Powder Washing for Metal Removal," just released. Equipment for powder washing is discussed as well as techniques for removing fins, pads, and sand inclusions. Removal of chill rods, and bars, reinforcing nails, and core chaplets is also covered. Some applications which have been experienced in actual foundry operations are listed in conclusion. Linde Air Products Co.

(27) Machine Metal Washing

The publication of a 16-page booklet, "8 Things to Look for When You Wash Metal by Machine," is announced. The booklet reviews specialized materials available for use in metal-washing equipment and tells in detail the jobs they do. In connection with the selection of detergents for use in metal-washing machines, the booklet provides helpful data on the following factors to be considered: (1) Is the cleaning material specially designed for your type of work? (2) Will the cleaning material help your machine operate more efficiently? (3) Does the "service" behind the detergent help you in obtaining good results? (4) What jobs are done best by solvent detergents? (5) What jobs are done best by alkaline cleaning materials? (6) How to prepare metal for painting; (7) Tips on selection and operation of washing machines; and (8) Special aids to better operation. Under the latter heading, the booklet describes helpful equipment available to promote efficient operation of metal-washing machines by simplifying determination of correct solution strength, operating temperature and upkeep, so that waste of cleaning materials is avoided. (F.8490). Oakite Products, Inc.

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1011 EMPIRE BUILDING
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PUBLICATIONS CURRENTLY OFFERED by Iron and Steel Engineer Advertisers

ITEM	COMPANY	BULLETIN	DESCRIPTION
50	ADAMS CO., INC., R. P.	BULLETIN 691	Adams Poro-Stone filters.
51	AMERICAN AIR FILTER CO., INC.	BULLETIN 250 F	Air protection for mill motors.
52	AMERICAN CHEMICAL PAINT CO.		Descriptive folder on "Rodine."
53	AMERICAN FLEXIBLE COUPLING CO.		Folder on Amerigear fully crowned tooth.
54	ASKANIA REGULATOR CO.	BULLETIN 115	Askania open hearth furnace control.
55	BLISS CO., E. W.		52-page brochure on mill accessory equipment.
56	BRISTOL CO.		Book on Bristol thermocouple and pyrometer accessories.
57	BRISTOL CO.		Catalog giving details of Dynamaster performance.
58	BROWNING AND CO., INC., VICTOR R.	BULLETIN "E"	Describes Browning mill type cranes.
59	CLEVELAND QUARRIES CO.	BULLETIN 15-B	Buckeye Silica Firestone.
60	CLEVELAND WORM AND GEAR CO.	CATALOG 400	Cleveland worm gear speed reducers.
61	COLUMBIA ELECTRIC MFG. CO.		Columbia motor generators.
62	CUNNINGHAM CO., M. E.		Literature on Mecco safety box type holders.
63	DELTA-STAR ELECTRIC CO.	PUBLICATION 4612	Describes "SL" interrupter switches.
64	DIAMOND POWER SPECIALTY CORP.	BULLETIN 1025E	Diamond "Utiliscope."
65	DURABLA MANUFACTURING CO.	BULLETIN S-4	Durabla pump valve units.
66	ELECTRIC SERVICE MANUFACTURING CO.	BULLETIN 681-B	Keystone LMI pony size collectors.
67	ELLIOTT CO., CROCKER-WHEELER DIVISION		Mill motor, brake motor, and sealed-power bulletins available.
68	FLOWER MANUFACTURING CO., D. B.	CATALOG 4	Flower electric brush holders.
69	FOOTE BROS. GEAR AND MACHINE CORP.		Five bulletins available on drives for every power transmission need.
70	GENERAL ELECTRIC CO.	BULLETIN GEA-4654	G-E mill motors with G-E control.
71	GULF OIL CORP.		Gulf rust preventives pamphlet.
72	HARNISCHFEGER CORP.	BULLETIN C-42	P&H mill type cranes.
73	KAISER ALUMINUM AND CHEMICAL SALES, INC.		Literature on Permanente 165 and Permanente 84.
74	KOPPERS CO., INC., FAST'S COUPLING DEPARTMENT		Catalog giving detailed descriptions, engineering drawings, capacity tables and photographs.
75	MEDART CO.		Medart's wire straightening and cutoff machine.
76	MINNEAPOLIS HONEYWELL REGULATOR CO., INDUSTRIAL DIVISION	DATA SHEET 6.4-8a	ElectroniK recorder.
77	MORGAN CONSTRUCTION CO.		Morgan-Isley combustion control system.
78	NORTHERN ENGINEERING WORKS	BULLETINS T-105, AH-103, H-111, HL-115 AND G-700	Bulletins on cranes and hoists.
79	OAKITE PRODUCTS, INC.	FOLDER 7993	Oakite metal cleaner.
80	PENNSYLVANIA TRANSFORMER CO.	BOOKLET 522	Economics of transformer cooling.
81	POOLE FOUNDRY AND MACHINE CO.		Catalog gives full description and engineering data.
82	POST-GLOVER ELECTRIC CO.	BULLETIN 500	Nonbreakable steel grid resistors.
83	PYLE-NATIONAL CO.	BULLETIN 1145	Complete listings of sealing grips.
84	ROCKBESTOS PRODUCTS CORP.		Booklet entitled, "Rx for a Building with Hardening of the Arteries."
85	SQUARE D CO.	BULLETIN 8938	Describes Square D control centers.
86	STANDARD CARBON CO.		Bulletin on Standard brushes.
87	TAYLOR CHAIN CO., S. G.		Booklet on TM alloy steel chain and attachments.
88	TIDE WATER ASSOCIATED OIL CO.		Bulletin on "Tide Water Associated Lubricania."
89	UNITED STATES GRAPHITE CO.		40-page catalog giving complete information on standard USG grades.
90	WAGNER ELECTRIC CORP.	BULLETIN MU-132	Corrosion-resistant motors.
91	WESTINGHOUSE ELECTRIC CORP.	BOOKLET B-4723	Westinghouse safety switches.
92	WESTINGHOUSE ELECTRIC CORP.	BULLETIN B-5261	Gives the complete Type M contactor story.
93	WILSON ENGINEERING CO., INC., LEE		Illustrated booklet on portable base furnaces.

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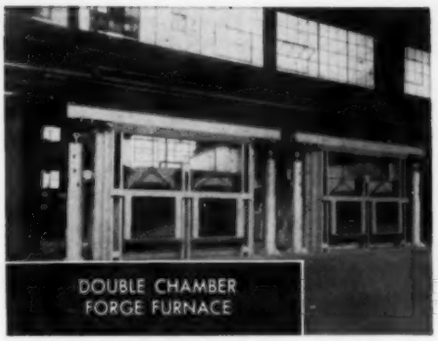
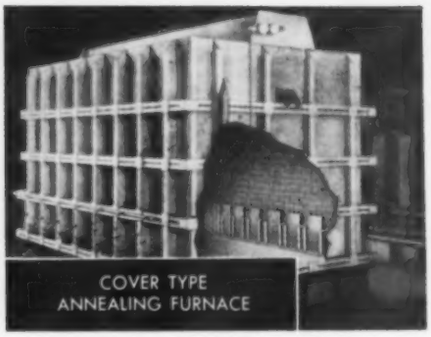
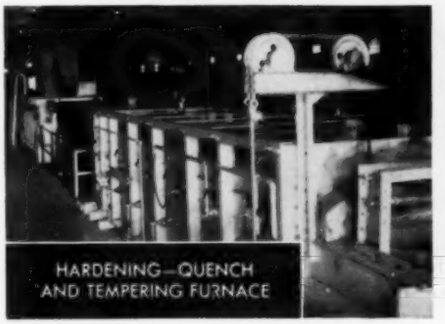

DOUBLE CHAMBER FORGE FURNACE

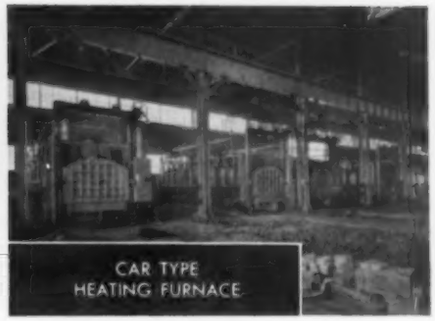
HEAT TREATING SHELL FORGINGS


COVER TYPE ANNEALING FURNACE

AMCO Designs, Erects and Operates

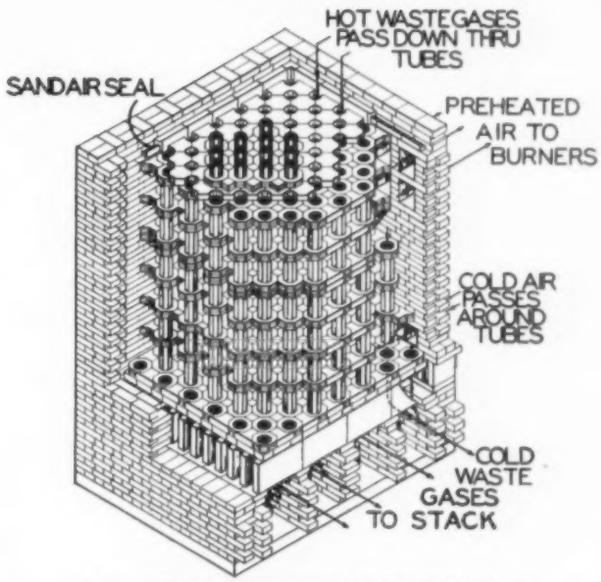

HARDENING—QUENCH AND TEMPERING FURNACE

OPEN HEARTH STEEL FURNACES


CAR TYPE HEATING FURNACE

World's Foremost Builders of Industrial plants and furnaces

SINCE 1916


HOT WASTE GASES PASS DOWN THRU TUBES
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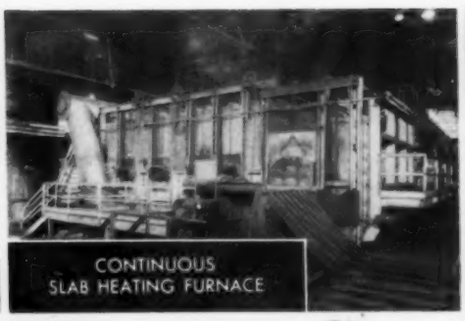
COLD WASTE GASES TO STACK

Over 1000 Successful Installations

INGOT HEATING FURNACES


CONTINUOUS SLAB HEATING FURNACE

PULVERIZED COAL FIRED CONTINUOUS BILLET HEATING FURNACE

Amsler Morton Corporation

CHAMBER OF COMMERCE BLDG., PITTSBURGH 19, PA.

(*Continued from Page 199*)

cars during winter months. This makes dumping difficult.

Before the Atlas company started equipping its cars with General Electric strip heaters, it was common practice to prevent freezing by putting a quantity of burning coke in the bottom of the hopper before loading it.

The barrage of heaters are clamped directly to the hopper plates in a manner which allows for expansion and contraction, and also makes individual easy to replace. Each group of heaters is connected to a fused safety switch at the control panel to facilitate maintenance. In order to transfer a maximum amount of heat by conduction to the hopper plates, the heaters are clamped directly to the plates.

The heaters, moreover, are enclosed in a steel cabinet with a thermal insulation fastened to the inside of the cabinet's surface. This prevents undue heat loss from the other side of the heaters so that the loss of heat by convection to the surrounding air is also used to warm the hoppers.

To avoid unnecessary use of the heaters and to conserve power, a G-E heavy duty industrial thermostat is adjusted to cut off power to the heaters when they are not needed. The heaters can be disconnected manually by means of a switch in the coil of the heater contactors.

CABLE CLAMP

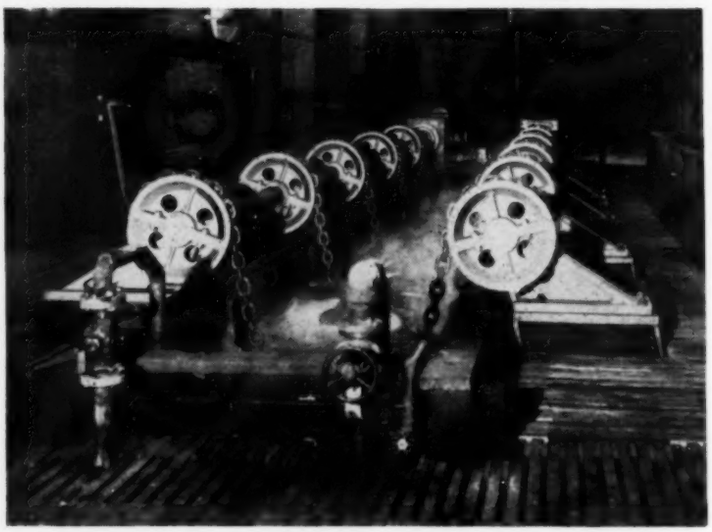
▲ A new quarter-bend cable clamp, the "Sky-Tie," has been conceived by engineers of Adalet Manufacturing Co. to meet the need for a fitting suitable for bus-drop cable.

Many of the plants turning out defense materials have been using bus-drop cable without conduit as an easy, simplified means of transmitting power to machine tools from bus duct. The method permits quick installation and ready rearrangement of machines. Power distribution by this means, however, entails a new conception of electrical fittings. Most important of these fittings is a supporting clamp for suspending the cables above the machines. A fitting which will anchor the cable at the busway and machine is also required. Both of these requirements are met by the dual-purpose clamp "Sky-Tie."

Two identical pieces form the device, joined by two heavy bolts, and installation is merely a matter of tightening these bolts with the support in position.

A spring is also desirable, and is used to keep the cables tight. This spring fits onto the "Sky-Tie" tangentically to its bend, ties back to a structural member, and absorbs vibration or shocks to the installation.

Cuts Pickling and Drawing Costs



In Major Ohio Steel Plant

"First things come first," states an old saying, and that's why this Weldco Mechanical Pickler is an important addition in the Cold Drawn Division of an Eastern Ohio steel mill. For the success of the cold-drawing operation depends on the proper pickling of the bars, and this pickling-descaling job comes "first."

The Pickler shown here is a 7½-ton Mechanical Bar Pickler in a floor-level tank 5' x 5' x 43'. This equipment pickles 120 tons per turn—rounds, squares, hexagons, and flats. The spreaders, chains, and foundation bolts are made of long-lasting, corrosion-resisting Monel.

Production records in this Ohio steel plant show a uniform, complete descaling operation, reduced pickling and drawing costs, longer die life, and fewer rejects at the drawbench . . . . all of which indicate a sound investment in pickling equipment that will soon pay for itself.

Weldco Mechanical Picklers are also available for pickling coils, tubing, and sheets . . . can be built to any capacity. Write today for complete information and descriptive literature.

THE YOUNGSTOWN WELDING & ENGINEERING COMPANY

3700 OAKWOOD AVENUE . . . YOUNGSTOWN 9, OHIO

The spring can be used on loads as high as 125 lb. The manufacturers point out that the weight of the cable does not necessarily determine the spring requirement. This is determined by the pull needed to keep the horizontal run of cable from sagging. Frequently 75 to 100 lb is exerted by cable whose weight may be only 15 lb. in itself.

OXYGEN INDICATOR

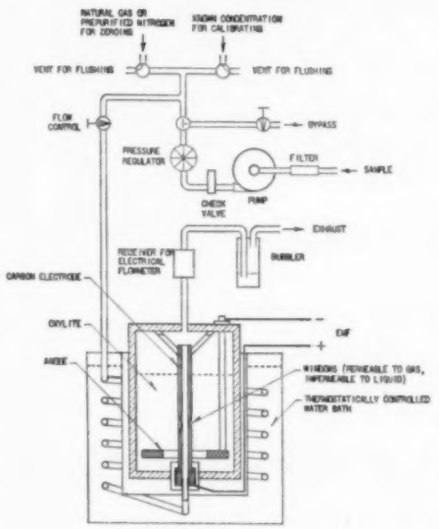
▲ A new and improved version of the MSA oxygen indicator has been introduced by Mine Safety Appliances Co. Called the "Type C-2" oxygen indicator, the new instrument is said to be more easily operated and maintained than the older "Type C."

The newest product in a line of instruments designed by MSA's research laboratories for measuring the oxygen content of industrial atmospheres, the indicator has been devised to provide an instrument which is materially simpler to operate than those being used.

For simpler maintenance, the new indicator has just three points which need attention: the carbon electrode which must be replaced periodically; the detector cell, which requires an ounce or two oxylite approximately every two weeks; and a dry cell — a No. 2 flashlight cell — which must be replaced every week.

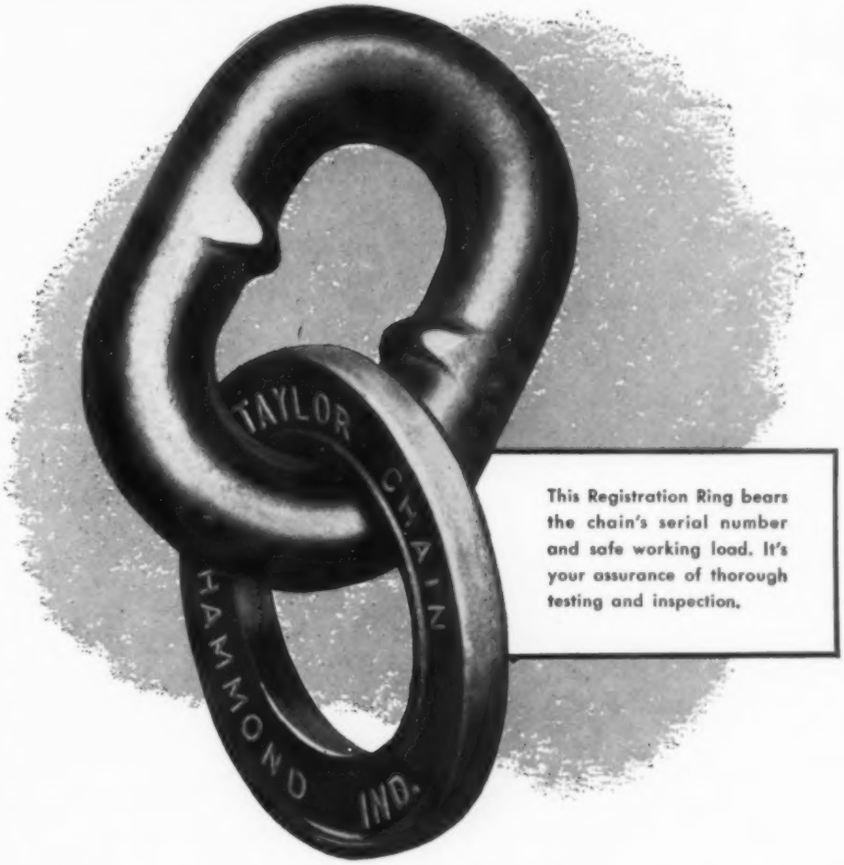
The new oxygen indicator, like the instrument it succeeds, can be used

This schematic flow diagram indicates use of the improved oxygen indicator with accessories for sample control and calibration. Direct reading to within two per cent of the selected scale range may be obtained as the instrument includes an integral, large-size meter with 50 scale graduations.



TM Alloy Steel CHAINS

DO MORE WORK, LAST LONGER, COST LESS ... THAN WROUGHT IRON TYPES



This Registration Ring bears the chain's serial number and safe working load. It's your assurance of thorough testing and inspection.

Your chain problems are substantially reduced when you buy TM Alloy Steel Chain. Records prove this famous chain *outlasts* and *outperforms* wrought iron types ... even under the toughest conditions. It's more economical too!

TM Alloy Steel Chain has twice the tensile strength. Controlled heat-treatment assures a uniform hardness of from 265 to 285 Brinell. These features make it highly resistant to abrasion, cold-working, grain growth and shock at all temperatures.

Send for free booklet containing all the facts and specifications on TM Alloy Steel Chain and attachments.

S. G. TAYLOR CHAIN COMPANY
Dept. 5, Hammond, Indiana
Rush literature and prices on TM Alloy Steel Chains.

NAME_____

ADDRESS_____

TAYLOR MADE
A GREAT NAME IN Chain SINCE 1873

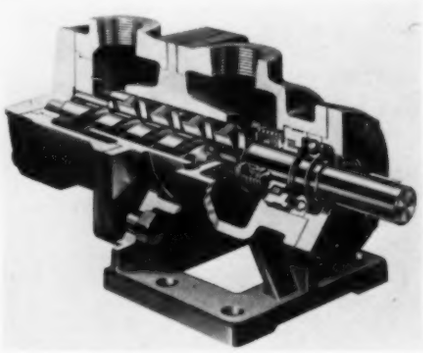
for a variety of operations in industry. It measures the oxygen content of inert and combustible atmospheres in chemical, metallurgical, and petroleum industries. Through the measurement of the oxygen content of fuel gases, it provides a means for improving the safety of utility operations and for controlling pipe line corrosion. As a measure of combustion efficiency, the indicator can show the way to substantial fuel economy in many large industrial installations.

To provide maximum usefulness for all applications, the instrument is available for any of the following standard, full-scale ranges: zero to one per cent; zero to five per cent; zero to ten per cent; and zero to 25 per cent. The instrument includes an integral, large-size meter which has 50 scale graduations. This makes it possible to obtain direct readings of oxygen concentrations in gas samples to within two per cent of the selected scale range.

ROTARY PUMP

▲ A new De Laval "IMO" pump, which saves up to 40 per cent in initial cost over other "IMO" models for similar pressures, has been announced by De Laval Steam Turbine Co. This pump is designed to handle a wide variety of oil handling applications for pressures up to 275 psi.

This new rotary positive displacement pump offers all the advantages of the "IMO" design. It has only three moving parts. It is reliable, quiet, pulsation-free, compact, excellent for high-speed operation. It can be used for capacities to 80 gpm, pressures to 275 psi and intermittent pressures up to 325 psi. This new pump handles light or viscous fluids in hydraulic systems, rotary and steam atomizing oil burners, lubrication, governing systems and similar services.



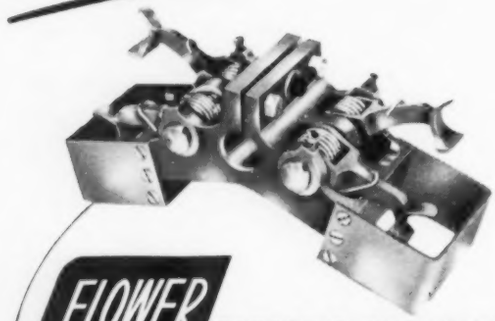
HAND LIFT TRUCKS

▲ Hand lift pallet trucks from the Philadelphia division, Yale & Towne Manufacturing Co. are now available with a dual-purpose superstructure that will enable them to handle 7 and 12 in. skids as well as single or double faced pallets.

When the superstructure is in a raised position, it is clamped vertically to provide a backrest for the pallet load on the truck. When lowered, it is adjustable to either 7 or 12 in. skid heights by a simple cam and slot arrangement. Yale feels that this truck will find application in those plants and business establishments where there is not sufficient volume of either skids or pallets to keep a specialized truck for each busy or where flexibility is desired.

The truck is available in either mechanical or hydraulic lifts. Platform trucks can be similarly equipped so that they can handle several sizes of skids.

Important!



FLOWER ELECTRIC BRUSH HOLDERS ARE JOB-DESIGNED

• Here is a double tandem brush holder specially designed for The Yoder Company's 4400 KVA welder—a typical example of Flower job-design and production. Discover how Flower brush holders save maintenance time and money. Get the facts!

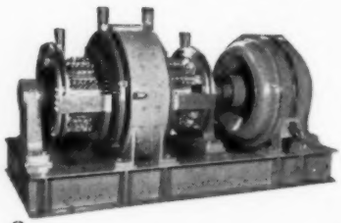
WRITE For Catalog 4

FLOWER ESTABLISHED 1900 D. S. FLOWER MANUFACTURING CO.

1217 SPRING GARDEN ST. PHILA. 23, PA.

COLUMBIA

MOTOR GENERATORS



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TONG TEST A. C. — D. C. AMMETERS

• TANK RHEOSTATS • REVERSING SWITCHES

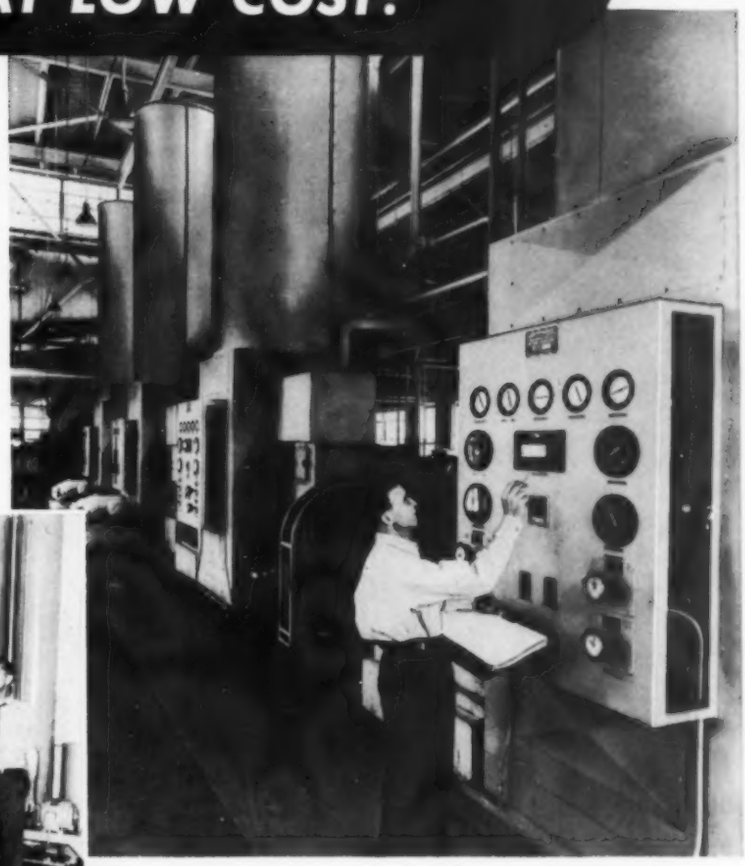
Write for Descriptive Bulletins

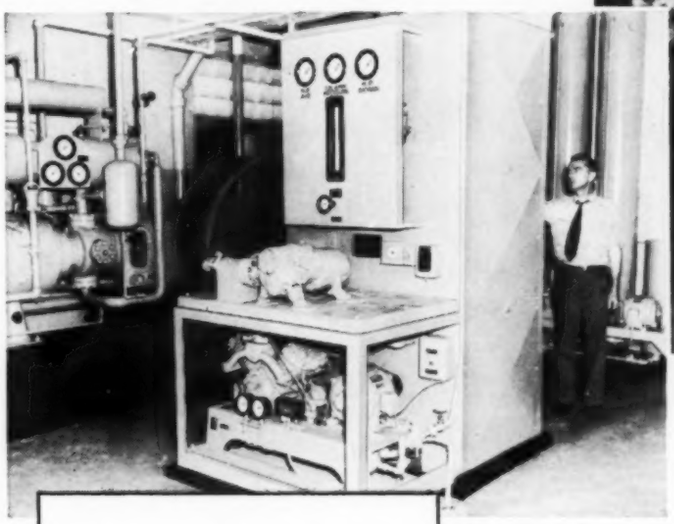
COLUMBIA ELECTRIC MFG. CO.
4543 HAMILTON AVE. CLEVELAND 14, OHIO

MAKE YOUR OWN OXYGEN and NITROGEN FROM AIR -- AT LOW COST!

Could You Use Large Quantities of Low-Cost Oxygen or Nitrogen?

If so, it will pay you to install an Air Products Generator and make your own. Numerous models are available with oxygen capacities from 200 cubic feet to 500,000 cubic feet per hour. *All of them have been proven by the acid test of operation in industry.*





ABOVE: Air Products Oxygen Generators in customer's plant. Capacity, 25,000,000 cubic feet per month.

LEFT: R-Series Air Products Oxygen Generator in customer's plant. Capacity, 500,000 cubic feet per month.

A Partial List of Users

American Chain & Cable Co., Inc.
Bethlehem Steel Co.
Thomas A. Edison, Inc.
Ford Motor Company
Granite City Steel Co.
Grede Foundries, Inc.
Hartford Hospital
Libby-Owens-Ford Glass Co.
Pettibone Mulliken Corp.
Pittsburgh Steel Foundry Corp.
Ross-Meehan Foundries
U. S. Armed Services

Noted for economy, dependability, and ease of operation, Air Products Generators employ the most advanced cycles, according to individual requirements.

Air Products, Incorporated, is a pioneer in the design and manufacture of oxygen-nitrogen generators and related equipment. A thoroughly experienced organization of over 500 people is occupied exclusively in this work. The overall background of Air Products in this field is unmatched by any other concern.

Air Products Generators have been in constant use for many years in the plants of nationally known companies. Some of these are listed at left. Air Products has effected substantial savings for all customers by eliminating the heavy costs, uncertainties and inconveniences of relying on outside sources.

We offer you experience based on the design and construction of over 400 successful oxygen-nitrogen generators.

Specialists in Equipment for All Low-Temperature Processes

Air Products OXYGEN — NITROGEN — ARGON **Generators**

AIR PRODUCTS, Inc., Dept. O, Box 538, Allentown, Pa.

Wagner
ELECTRIC MOTORS
...the choice of leaders in industry

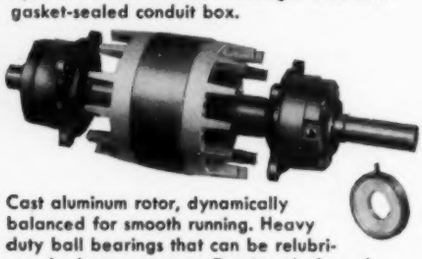
Wagner
CAST IRON FRAME MOTORS
resist corrosion...

Wagner cast iron motors are built for use in chemical plants, oil fields, refineries, steel mills—wherever protection against corrosion is a required feature. They are totally-enclosed and fan-cooled to fully protect their operation against corrosive agents, dirt and dust.

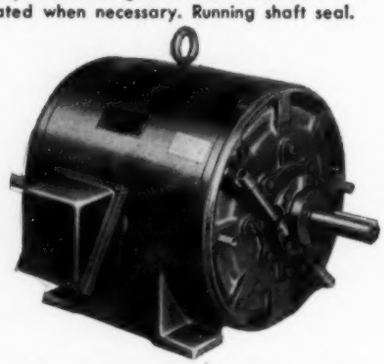
Where additional protection against explosive atmospheres is desired, an explosion-proof design (type JP) is available. Both the standard (type EP) and the explosion-proof types are built in ratings from 2 to 250 hp, with either normal or high torque characteristics. Wagner Bulletin MU-132 gives complete information on these corrosion-resistant motors. Write for your copy today.

features like these give extra protection-

Frame of rugged cast iron. Completely protected laminations. Special varnish treated windings. Cast iron gasket-sealed conduit box.



Cast aluminum rotor, dynamically balanced for smooth running. Heavy duty ball bearings that can be relubricated when necessary. Running shaft seal.



Cast iron endplates, ribbed to add extra mechanical strength.

Externally mounted blower of corrosion-resistant material—malleable iron on type EP, non-sparking bronze on type JP.

®Wagner Electric Corporation EST. WE 1891

WAGNER ELECTRIC CORPORATION
6483 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS – AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

MU-9

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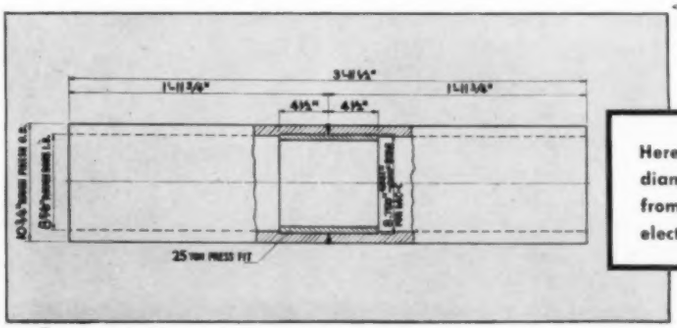

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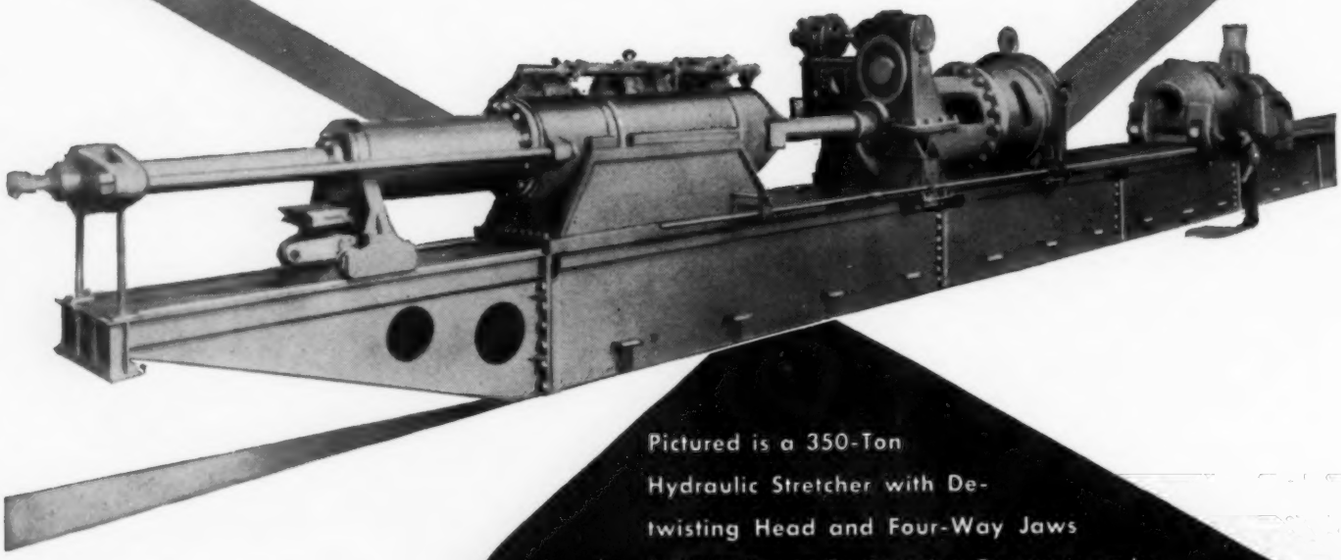

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▲ **"NEMA Standards for Electric Power Connectors, Publication No. SG1-1952,"** a revision of Publication No. 37-47 contains standards for the current ratings of bare copper and aluminum conductors; rated frequency; basis of temperature rise; identification marking; thread dimensions; and bolts, nuts and lockwashers for connectors. Information is also given concerning the temperature rise, resistance, strength and radio influence voltage tests. The various types of connectors are defined and classified. Price $2.00 per copy.

▲ **"Manufacturing Processes,"** by Myron L. Begeman has been reissued in a third edition by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y., 6 × 9 in., 608 pp, price $6.00. This book has been written primarily for students and professionals engaged in production, industrial and tool engineering work. It covers information on most of the important manufacturing processes and machines which are now available. Of importance, are the discussions on how this equipment can best be applied, their advantages and drawbacks and the tools required for each machine. The third edition brings the previously popular editions up to date to cover the latest machines and processes which have been developed in the past five years. Book covers foundry practice, pattern work, hot and cold working of metals, heat treatment, measuring instruments, cutting tools, machines and accessories.

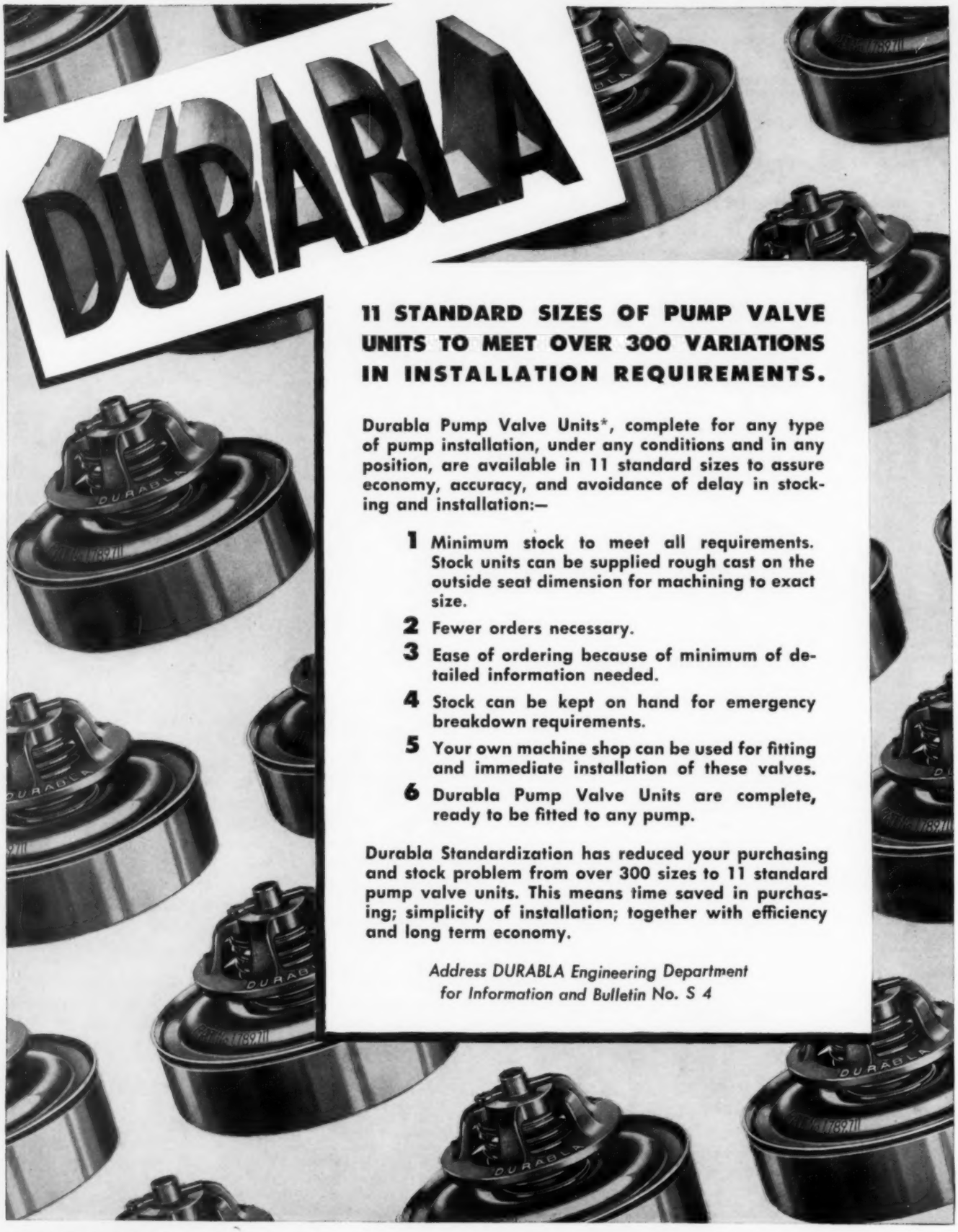
▲ **"Basic Open Hearth Steelmaking"** published by the AIME in the Seeley W. Mudd series has been revised in an enlarged edition No. 2, 6 × 9 in., cloth bound, 940 pp, $8.00. This book fills a long-felt need for authoritative, up-to-date information regarding the operation of the basic open hearth steelmaking process. It explains in part one—in simple terms—the construction of the plant and furnaces, operation of the furnaces and auxiliaries in steel manufacture, open hearth refractories, fuels, instrumentation, raw materials, refining the molten steel and slag control, as well as a study of segregation and nonmetallic inclusions. In part two the authors delve into the mysteries of the physical chemistry of high temperature reactions, slag-metal reactions, thermal changes in melting and refining, the theory of combustion and heat transfer and the phenomena related to the principles of the metallurgy of steel manufacture.

▲ **"NEMA Standards for Color Markings for Electrode Identification, Publication No. EW2-1952,"** supersedes Publication No. EW2-1950 and identifies by color all arc-welding electrodes for which a standard identification has been established. Price $0.25 per copy.

▲ **"Treatise on Powder Metallurgy,"** by Claus G. Goetzel, Vol. III, the third volume in this series has just been published by Interscience Publications, Inc., 250 Fifth Ave., New York 1, N. Y. This book is similar in format to the previous two volumes and consists of 899 pages, cloth bound, 6 × 9 in., price $22.00. This third volume consists of a complete classification and annotated bibliography on the subject of powder metallurgy. The first part is a complete literature survey covering 5535 references, and the second part is a patent survey covering 6330 items. There is, in addition, a patent cross index, a subject index and a name index.

▲ **"Heating, Ventilating, Air Conditioning Guide-1952,"** Vol. 30, an annual publication of the ASHVE, has just been issued and may be obtained from 62 Worth St., New York 13, N. Y., 1496 pp, 6 × 9 in., Cloth bound, price $7.50 per copy. This guide brings up to date the latest developments on heating, ventilating and air conditioning. The arrangement of the book is similar to previous editions.

▲ **"The Transaction of Sixteenth Annual Meeting,"** of the Industrial Hygiene Foundation of America, 4400 Fifth Ave., Pittsburgh, Pa. has been issued in a 96 page paper-bound booklet, 6 × 9 in., price $1.50 each. This meeting was held in November, 1951 and covered the theme "The Executive and Health."



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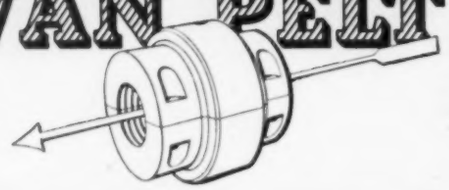

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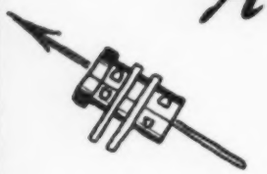

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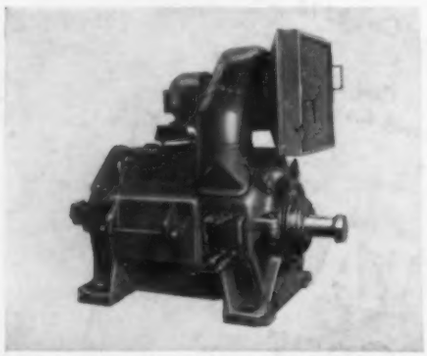

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